CBECC-COM 2013

User Manual
Version 1f
March 21, 2014

About This User Manual

This user manual provides information for using CBECC-Com in one, comprehensive document.

The information presented is current as of the release on the title page. Please refer to the *Quick Start Guide for CBECC-Com 2013* at http://bees.archenergy.com for the latest enhancements and updates to the software.

Document Conventions

Convention	***Usage***
Emphasis	*For emphasis, Italic type is used.*
Menu commands, commands, options, user input, and tabs	These items found in the user interface are **bolded.**
TIP	This word in a text box indicates an important tip, reminder, or additional information about a particular item, e.g., informational notes or definitions.

Support Information

If you experience any issues with the software, we welcome your feedback to help improve CBECC-Com. Prior to submitting an issue, please verify that you are using the latest release of CBECC-Com. If you are using an older version, refer to the current *Quick Start Guide* and check the release notes to see whether it has been addressed. If you are using the latest release, then please submit an issue in as much detail as possible using the form at http://bees.archenergy.com/issue.html.

Table of Contents

OVERVIEW VI
Energy Commission Approval vi
Software Capabilities vi
STANDARD INPUT AND OUTPUT REPORTS 1
Basic Output Results 1
Certificate of Compliance Report 1
Analysis Results XML File 2
Log File 4
EnergyPlus Output Files 5
Error Reporting 5
FIXED AND RESTRICTED INPUTS 7
Classification of Input Types in CBECC-Com 7
PREPARING BASIC INPUT 8
Building Geometry – Detailed vs Simplified 8
Where to Get Additional Software Tools 9
Creating Building Geometry Using the OpenStudio Plug-In for Trimble SketchUp 10
Exporting the Model to SDD XML 11
STARTING A NEW PROJECT 13
Importing Geometry into the CBECC-Com User Interface 13
Simplified Geometry - Creating Building Geometry Using the CBECC-Com Interface 15
THE CBECC-COM USER INTERFACE 17
Organization of the Envelope Tab 18
Organization of the Envelope Tab (continued) 19
Organization of the Envelope Tab (continued) 20
Organization of the Envelope Tab (continued) 21
Envelope Input Screen Details 22
Project Data Screen (Project Data Tab) 22
Project Data Screen (Design Team Tab) 23
Project Data Screen (Exceptional Conditions Tab) 24
Project Data Screen (Non-Compliance Analysis Tab) 25
Building Data Screen 27
Building Story Data Screen 29

Space Data Screen (Space Data Tab) 30
Space Data Screen (Daylighting Tab) 33
Space Data Screen (Infiltration Tab) 36
Interior Lighting System Data Screen 37
Exterior Wall Data Screen 39
Subsurface Data (Window) Screen 40
Sub Surface (Door) Data Screen 41
Poly Loop Data Screen 42
Surface Data (Interior Wall) Screen 43
Roof Data (Surface Data) Screen 44
Underground Floor Data (Surface Data) Screen 45
Schedules Data Screen 46
Schedules Weeks Data (Weekly) Screen 47
Schedules Days Data (Daily) Screen 49
Construction Assembly Data Screen 51
Construction Assembly Data Screen (Compatible Surface = Roof) 53
Construction Assembly Data Screen: (Compatible Surface = UndergroundFloor) 54
Material Data (Single Layer) Screen 55
Materials Data (Single Layer) Screen (Category = Concrete) 56
Materials Data (Composite) Screen 57
Fenestration Construction Data Screen 58
Exterior Shading Object Data Screen 60
Door Construction Data Screen 61
Space Function Defaults Data Screen 62
Luminaires Data Screen 65
Organization of the Mechanical Tab 66
Organization of the Mechanical Tab (continued) 67
Mechanical Input Screen Details 68
Project Data Screen 68
Fluid System Data Screen 68
Chiller Data Screen 70
Fluid Segment Data Screen 72
Pump Data Screen 73
Boiler Data Screen 74
Heat Rejection Device Data Screen 76
Building Data Screen 77
Air System Data Screen 78
Air Segment Data Screen 81
Cooling Coil Data Screen (Chilled Water) 82

Cooling Coil Data Screen (Direct Expansion) 84
Heating Coil Data Screen (Hot Water, Steam) 86
Heating Coil Data Screen (Resistance, Furnace, Heat Pump) 89
Fan Data Screen 91
Terminal Unit Data Screen 93
Outside Air Control Data Screen 95
Thermal Zone Data Screen 97
Linear Curve Data Screen 99
Quadratic Curve Data Screen 100
Cubic Curve Data Screen 101
Double Quadratic Curve Data Screen 102
SPECIAL FEATURES AND MODELING ASSUMPTIONS 103
FIELD VERIFICATION 104
CHECKLIST FOR COMPLIANCE SUBMITTAL 104
SAMPLE COMPLIANCE DOCUMENTATION 104
COMPLIANCE STATEMENT 105
RELATED PUBLICATIONS 105

Overview

CBECC-COM 2013 is an open-source software program developed by the California Energy Commission for use in complying with the 2013 update to the *Non-Residential Building Energy Efficiency Standards.* This user manual for *CBECC-COM 2013* was written to accompany beta-test versions of the software released starting in June 2013.

This user manual provides detailed descriptions of the software program's major features. It is a good idea to review the *Quick Start Guide for CBECC-Com 2013* before using the program for the first time or if you have questions while using the program. Additional Help features will be added to future versions of the program.

Calculate the annual energy use for both the Proposed Design and the 2013 Standard Design of "typical" non-residential buildings. The feature set of CBECC-Com is listed in the section "Software Capabilities."

Energy Commission Approval

TBD

Software Capabilities

The CBECC-Com software's scope, features, and capabilities are listed below.

Scope

1. Newly constructed buildings
2. CBECC-Com will produce results of the performance tests described in the *2013 Title 24 Nonresidential ACM Reference Manual*.
3. The 2013 Standards ruleset and rules processing software have the capability to be included in third party compliance software using Dynamic Linked Libraries (DLLs) and includes ruleset encryption to "lock" the 2013 Standards ruleset.

Site/Building

1. Include identifying information
2. Include other general information required for compliance forms
3. Include location information
4. Identify climate zone and weather/design day files from the project site ZIP code

Envelope

1. Provide a comprehensive list of accurately described opaque materials
2. Combine materials into constructions
3. Describe fenestration performance properties via the simplified approach (e.g., U-value, Solar Heat Gain Coefficient, Visible Transmittance)
4. Apply exterior insulated constructions to demising surfaces
5. Check that proposed exterior constructions meet mandatory U-value requirements
6. Remove user model building shades
7. Retain user model geometry
8. Adjust excess user model fenestration to standard design maximum WWR and SRR values

Lighting and Other Internal Loads

1. Replace user lighting systems with simple Light Power Density (LPD) values based on space function
2. Allow simple lighting inputs for LPD and lighting schedules without the need to specify details of an interior lighting system
3. Allow detailed lighting inputs for credits and allowances:
    a. Lighting Controls and associated PAFs
    b. Area Category Lighting Allowances
    c. Tailored Lighting Allowances
4. Replace user occupancy and equipment loads with ACM-specified values
5. Replace user-specified infiltration rates with ACM values
6. Replace user-specified schedules with ACM schedules
7. Combine space-level data into zones

HVAC

1. Replace user-specified HVAC system with baseline system
    a. Except data center, laboratory, kitchens
    b. Baseline sizing run is autosized.
    c. Baseline run hard sized using baseline sizing results
2. Model user- specified HVAC systems with user-supplied sizing:
    a. PSZ
    b. SZVAV
    c. PVAV
    d. VAV
    e. PTAC
    f. PTHP
    g. Fan-coil units (4 pipe)
    h. Baseboard heating
    i. Heating coils
        i. Gas furnace
        ii. Hot water
        iii. Electric
        iv. DX (heat pump)
    j. Cooling coils
        i. Chilled water
        ii. DX
    k. Boilers
        i. Hot water
        ii. Gas
        iii. Oil
        iv. Electric
        v. Natural draft
        vi. Mechanical draft
    l. Chillers
        i. Screw
        ii. Reciprocating
        iii. Centrifugal
        iv. Air-cooled

v. Water-cooled
m. Chilled water loop pumping
i. Primary only
ii. Primary-secondary
n. Economizers
i. Non-integrated
ii. Integrated
o. Economizer Controls
i. Fixed temperature
ii. Differential temperature
iii. Fixed enthalpy
iv. Differential enthalpy

Domestic Water Heating

1. Storage water heaters
   a. Gas
   b. Electric
   c. Oil
2. Recirculating DHW systems for residential occupancies

Output

1. Report simulation errors and warnings including useful descriptions
2. Report number of hours with setpoint not met by thermal zone
3. Report energy consumption by fuel and end-use
4. Report TDV energy by end use
5. Report TDV energy comparison of Proposed and Standard Design, including Compliance Margin
6. Generate "Perf-1" summary compliance form

Interface

1. Ability to access and modify parameters needed to simulate the above
2. Option to perform simulations in two modes:
   a. Proposed Only (applies rules and simulates the Proposed Design)
   b. Proposed and Standard (applies rules and simulates the Proposed and Standard Designs)
3. *CBECC-Com Quick Start Guide* available from the **Help** tab
4. CBECC-Com software license available from the **Help** tab

Documentation

1. *2013 Title 24 Nonresidential ACM Reference Manual*
2. EnergyPlus Technical Documentation
3. Meeting criteria in *2013 Nonresidential ACM Approval Manual* (e.g., CBECC-Com User Manual)
4. Issues Log available with each CBECC-Com version release—to document bugs identified and fixed

Standard Input and Output Reports

A variety of input and output reports are available to review the compliance analysis. These reports are described below.

Basic Output Results

At the completion of the analysis, the Basic Output Results screen shows the energy use summary for the building and each end-use in terms of Site energy (by fuel type) and kTDV. This output screen also reports a summary of unmet load hours, a compliance margin for each end-use and the whole building, and an indication of whether the building passes or fails the compliance analysis. See Figure 1 for an example of the Basic Output Results screen.

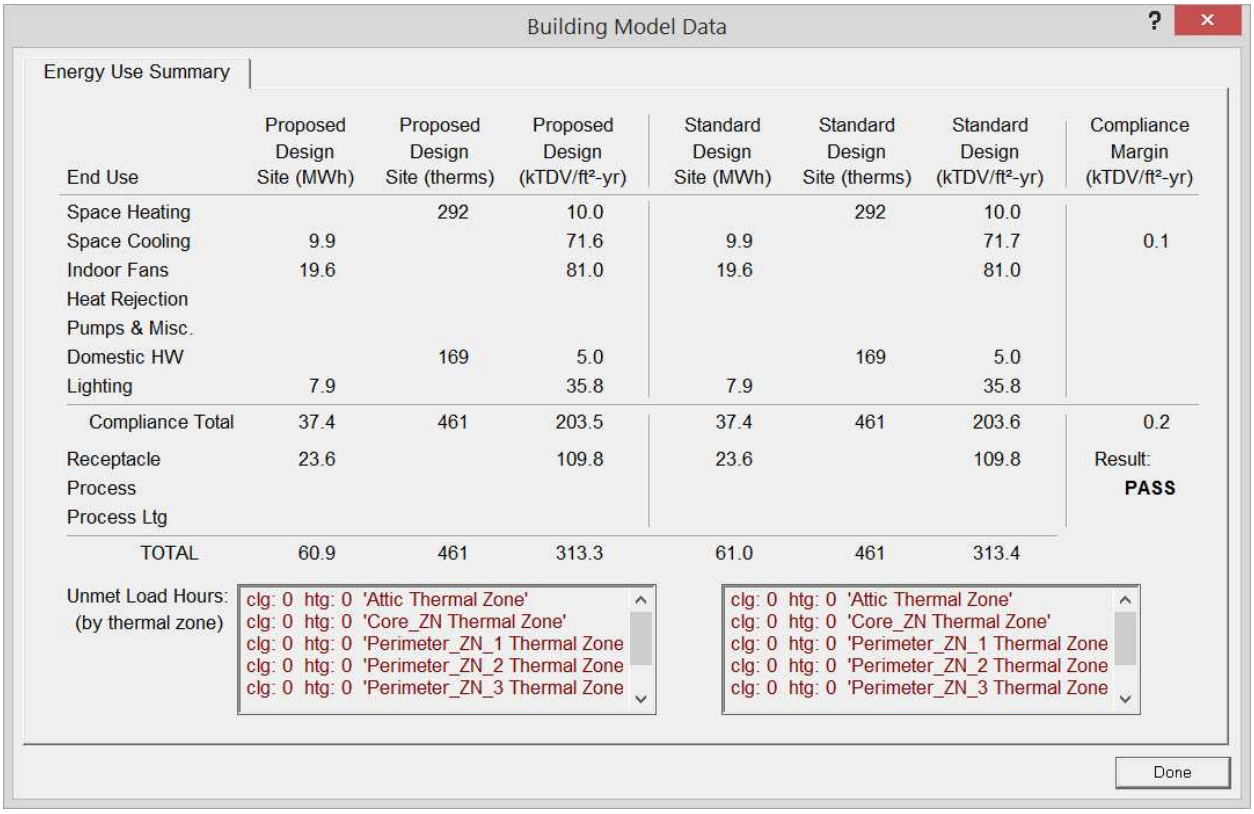

Building Model Data
Energy Use Summary
End Use
Proposed Design Site (MWh)
Proposed Design Site (therms)
Proposed Design (kTDV/ft²-yr)
Standard Design Site (MWh)
Standard Design Site (therms)
Standard Design (kTDV/ft²-yr)
Compliance Margin (kTDV/ft²-yr)
Space Heating 292 10.0 292 10.0
Space Cooling 9.9 71.6 9.9 71.7 0.1
Indoor Fans 19.6 81.0 19.6 81.0
Heat Rejection
Pumps & Misc.
Domestic HW 169 5.0 169 5.0
Lighting 7.9 35.8 7.9 35.8
Compliance Total 37.4 461 203.5 37.4 461 203.6 0.2
Receptacle 23.6 109.8 23.6 109.8
Process
Process Ltg
Result: PASS
TOTAL 60.9 461 313.3 61.0 461 313.4
Unmet Load Hours: (by thermal zone)
clg: 0 htg: 0 'Attic Thermal Zone'
clg: 0 htg: 0 'Core_ZN Thermal Zone'
clg: 0 htg: 0 'Perimeter_ZN_1 Thermal Zone
clg: 0 htg: 0 'Perimeter_ZN_2 Thermal Zone
clg: 0 htg: 0 'Perimeter_ZN_3 Thermal Zone
clg: 0 htg: 0 'Attic Thermal Zone'
clg: 0 htg: 0 'Core_ZN Thermal Zone'
clg: 0 htg: 0 'Perimeter_ZN_1 Thermal Zone
clg: 0 htg: 0 'Perimeter_ZN_2 Thermal Zone
clg: 0 htg: 0 'Perimeter_ZN_3 Thermal Zone
Done

Figure 1 – Basic Output Results

Certificate of Compliance Report

CBECC-Com produces the Certificate of Compliance for the Nonresidential Performance Compliance Method, NRCC-PRF-01-E. Refer to the section ***Sample Compliance Documentation*** for a detailed description of the report.

Analysis Results XML File

Additionally, a full summary of all building inputs and outputs used in the compliance analysis are generated during the analysis. This data is captured in an XML file called:

<project file name> - Analysis Results.XML

The AnalysisResults XML file is saved in the same folder location as the project CIBD file.

The AnalysisResults XML file contains data for each model used in the analysis:

- The Original User Model
- The Proposed Design Model
- The Standard Design Model

Figure 2 below shows the organization of the XML file containing details for each of the three analysis models.

Figure 2 – AnalysisResults.XML: Three Analysis Models

Figure 3 shows an example of the analysis output results for the Proposed Model. The EUseSummary tag contains annual TDV energy results for each end use (which are reported in the Basic Output Results screen shown in Figure 1). The EnergyUse tag shows a detailed energy consumption summary for each building end-use. The data includes total TDV energy consumption, total site energy consumption, and a breakdown of TDV and site energy by each fuel type for that end use.

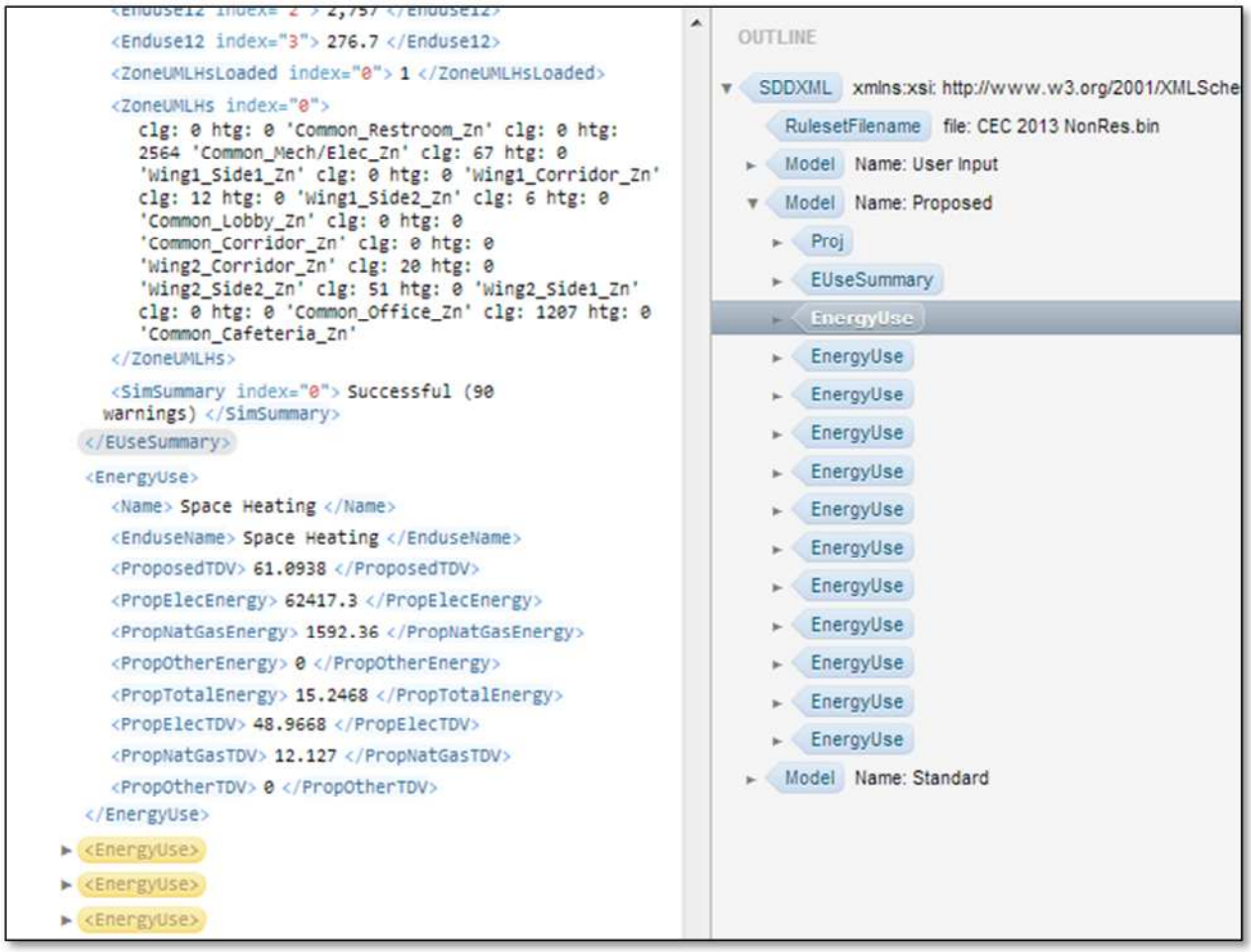


Figure 3 – Analysis Output Results for each End Use

Additionally, full reports of all building inputs for each analysis model are echoed in the AnalysisResults XML file. The organization of the input data follows the Standards Data Dictionary (SDD) data model structure. Figure 4 illustrates the XML format of the Building data.

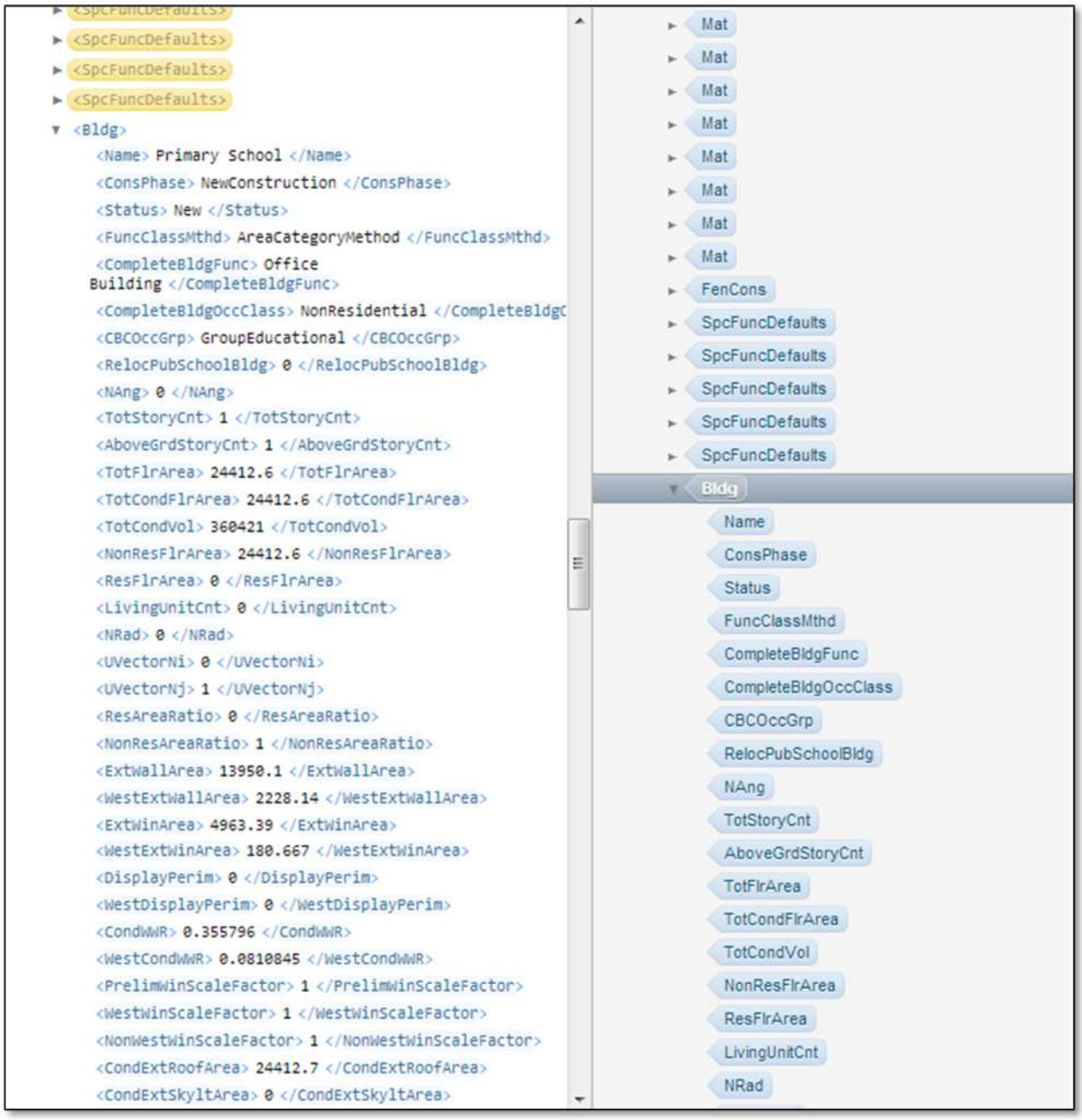


Figure 4 – Echo of All Building Inputs in the AnalysisResults XML File

Log File

A log file is associated with every CBECC project. It is located in the same folder as the project .cibd file and is named: <project name>.log. The log file contains a history of when the project was opened, saved, analysis performed, and any errors or warnings that occurred during analysis.

EnergyPlus Output Files

A set of EnergyPlus output files are generated during each simulation performed, and are listed below. For additional details on these EnergyPlus output files, please refer to the EnergyPlus documentation that can be found here:
http://apps1.eere.energy.gov/buildings/energyplus/energyplus_documentation.cfm

Error Reporting

CBECC-Com provides error messages if the compliance analysis fails. Each error message has a numerical code listed below.

1. pszBEMBasePathFile doesn't exist
2. pszRulesetPathFile doesn't
3. pszSimWeatherPath doesn't
4. pszDHWDLLPath specified, but doesn't
5. Invalid project log file name (too long)
6. Error writing to project log
7. Building model input/project file not found
8. Error reading/initializing model input/project file
9. Errors encountered evaluating input model defaulting rules
10. Errors encountered evaluating input model defaulting rules (multiple times)
11. Error(s) encountered performing required data & numeric range checks
12. Error(s) encountered checking input model for simulation compatibility
13. Error(s) encountered checking input model for code requirements

14. Error encountered initializing weather file locations and/or names
15. Error creating or accessing the analysis processing directory
16. Error generating Proposed Sizing model
17. Error generating Proposed (final) model
18. Error generating Standard Sizing model
19. Error generating Standard (final) model
20. Error initializing Standard Sizing model
21. Error initializing Standard (final) model
22. Analysis aborted - user chose not to overwrite SDD XML file
23. Error: Unable to write SDD XML file
24. Error(s) encountered simulating Proposed model
25. Error(s) encountered simulating Standard Sizing model
26. Error(s) encountered simulating Standard (final) model
27. Error(s) encountered retrieving Proposed model simulation results
28. Error(s) encountered retrieving Standard Sizing model simulation results
29. Error(s) encountered retrieving Standard (final) model simulation results
30. Proposed model zone(s) exceed unmet load hours limits
31. Error initializing building model database
32. Error loading analysis ruleset
33. User aborted analysis via progress dialog 'Cancel' button
34. Invalid results object types
35. Error copying results objects from a previous model
36. Error copying equipment sizes/flows from source model
37. Error(s) encountered reading building model (input/project) file
38. Error: EnergyPlus simulation engine not found.
39. Error: Version of EnergyPlus installed not compatible with analysis.
40. Error setting up check of weather & design day file hashes
41. DHW simulation not successful

(Return values in the range 101–200 describe issues encountered during/by simulation.)

101 : SDD XML simulation input file not found
102 : Simulation weather file not found
103 : Simulation processing path not valid
104 : Simulation executable path not valid
105 : Simulation error output path/file not valid
106 : User aborted analysis
131 : Error encountered in OpenStudio loading SDD XML file
132 : Error encountered in OpenStudio saving model to OSM file
133 : Unable to locate EnergyPlus simulation SQL output file
134 : OpenStudio Model not valid following simulation
135 : OpenStudio Facility not valid following simulation
136 : Error creating OpenStudio Model object
161 : Fatal error(s) occurred in EnergyPlus simulation
162 : EnergyPlus simulation did not complete successfully
181 : User aborted analysis during building model simulation

Fixed and Restricted Inputs

CBECC-Com utilizes fixed and restricted inputs for both the Standard Design, and elements of the Proposed Design as specified in the *2013 Nonresidential Alternative Calculation Methodology* (NACM) *Reference Manual*.

A detailed summary of all fixed and restricted inputs can be found in the *Nonresidential Alternative Calculation Method Reference Manual (NACM)*:

http://www.energy.ca.gov/2013publications/CEC-400-2013-004/CEC-400-2013-004-SD.pdf

Classification of Input Types in CBECC-Com

The user interface provides feedback on different types of inputs by displaying text in a variety of colors. The following summarizes the meaning of each text color.

Type of Input	Text Color	Meaning
Undefined	Black	Data currently has no value in the building description. The only time anything that is "undefined" is written or displayed in the user interface (UI) is when an enumeration list selection (select from a drop-down list or enter information) includes a "- none -" entry, which is displayed in this color.
Program Default	Dark Cyan	When an enumeration list is defined in the Enums.txt file (along with a valid default setting) and no DEFAULT rule expression is present in the ruleset, then the default selection displays in the UI using this color.
Rule Defined	Dark Blue	All fields that are set via DEFAULT or other ruleset expressions
User Defined	Dark Red	Any field that was input or specified by the user. These data are all written to project (CIBD/XML) files to persist across each CBECC session. Some data that is set by the program is also characterized as User Defined whenever it is something that is important to be available in future CBECC sessions of that project.
Simulation Results	Dark Green	When simulation results are pulled directly out of sim output files and posted to the building model, then they are typically flagged as SimResults. Most of the results shown in CBECC are processed by the ruleset and therefore display as Rule Defined, but some data including zone UMLH results are displayed in green immediately following the analysis.

Preparing Basic Input

In order to start a new project, the user must first prepare basic input into a model that describes his/her building project. This model is called the ***User Model***. During the analysis calculation procedure, this model is used to automatically define the two compliance models:

1. The ***Proposed Design Model—***the Proposed Design model is very similar to the User Model; however, some inputs such as schedules, plug-loads, and others are replaced with prescribed values specified in the NACM.
2. The ***Standard (Baseline) Design Model—***the Standard Design model is generated according the Standard Design rules in the NACM. Users can think of this model as a hypothetical version of their building if it was designed to just meet the mandatory and prescriptive requirements of the Title 24 (Part 6) standards.

The workflow for preparing the User Model and performing compliance analysis is broken into several steps. While the majority of the data input and the analysis procedures take place directly in the CBECC-Com user interface, additional free software tools (identified below) are used for some elements of the analysis. The data is captured in a data model called the Standards Data Dictionary (SDD). SDD models are represented by an XML file format that can be read and written by CBECC-Com. CBECC-Com converts this file to a .CIBD file extension (the software's native file extension).

- Building geometry and zone assignments can be generated within the CBECC-Com interface or using the **OpenStudio plug-in for Trimble SketchUp (v 8.0)**.

Building Geometry – Detailed vs Simplified

Building geometry generated using the OpenStudio plug-in is referred to as the *Detailed Geometry* approach and geometry generated using the CBECC-Com interface is referred to as *Simplified Geometry* approach. Using the OpenStudio plug-in the geometry can be exported to SDD XML file format for input into the CBECC-Com user interface.

The key difference between the two approaches is that the *Detailed Geometry* approach requires the user to draw the building and all its elements using a drawing tool, in this case SketchUp with the OpenStudio plug-in. This approach accurately represents a building and its elements in the 3-dimensional form. Spatial relationships and properties of the building surfaces such as areas, orientation and tilt are automatically calculated the 3-dimensional drawings. The *Simplified Geometry* approach on the other hand defines the properties (areas, orientation, tilt etc.) of the building surfaces within the CBECC-Com interface, but the spatial relationship between surfaces is not defined. Description of the *Simplified Geometry* approach can be found in subsequent sections of the manual.

- After building geometry has been created the remainder of the User Model building inputs is entered in the **CBECC-Com** user interface.
- The compliance analysis is launched within the CBECC-Com user interface. When the analysis is launched, CBECC-Com automatically generates the Proposed Design model and the Standard Design (also referred to as the Baseline Design) model in SDD XML format.
- The SDD XML files are translated by the **OpenStudio Translator** to EnergyPlus IDF files. This process is automated by CBECC-Com and requires no intervention by the users.
- The IDF files are be simulated by the **EnergyPlus v8.0** engine. Three simulations occur:
    - The Proposed Design annual simulation (to calculate annual energy and TDV energy consumption)

- The Standard Design sizing simulation (to automatically determine HVAC system sizes for the Standard Design)
- The Standard Design annual simulation (to calculate annual energy and TDV energy consumption)
  Note: the simulation processes are automated by CBECC-Com and require no intervention by the users. A progress indicator provides feedback to users on the status of the simulations.

- Results from the EnergyPlus simulations are automatically retrieved by CBECC-Com and presented in a results summary screen.

This workflow is illustrated below in Figure 5. Additional details for each step in the workflow are also provided below.

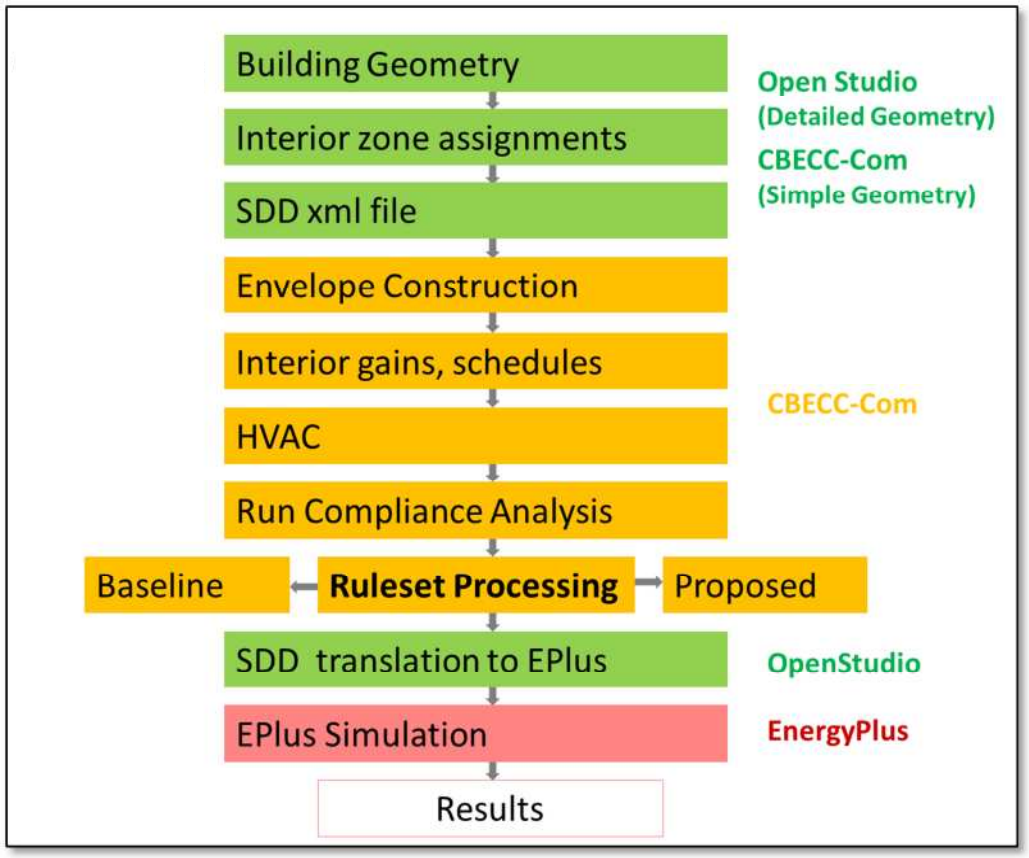


Figure 5 – Workflow for Non-Residential Compliance Analysis

Where to Get Additional Software Tools

Additional software tools can be found either within CBECC-Com or at the following websites.

Trimble SketchUp (v8.0): http://www.sketchup.com/download/all

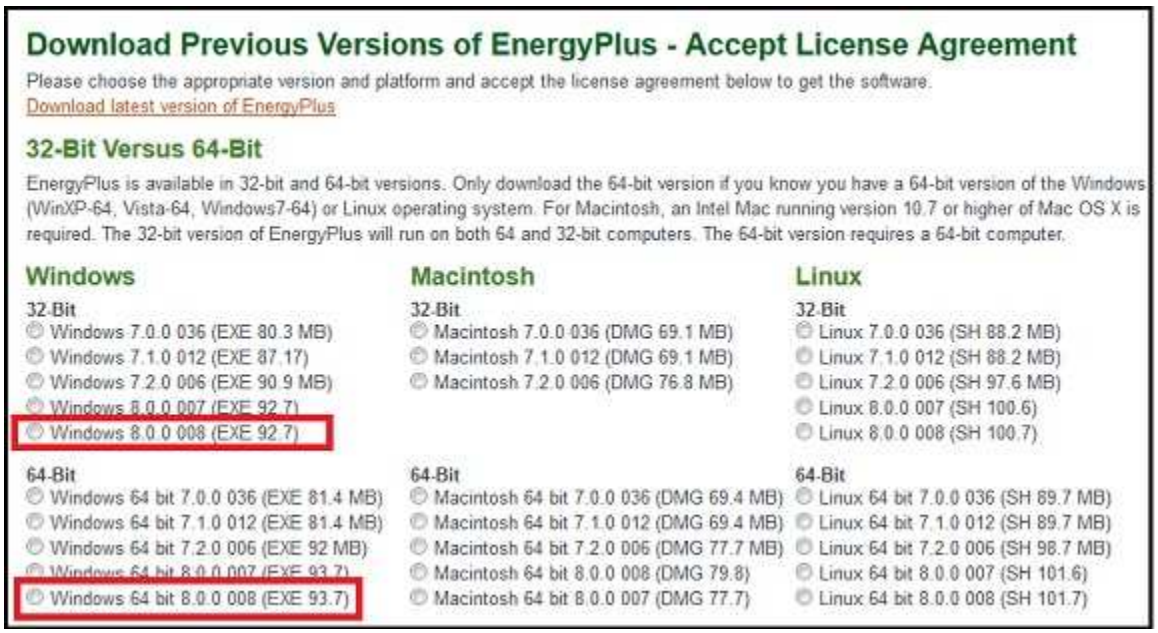
OpenStudio SketchUp Plug-In: http://openstudio.nrel.gov/downloads

Note: For CBECC-Com v1f you no longer need to install EnergyPlus 8.0 separately. EnergyPlus executables are now included in the CBECC-Com v1f installer. For previous versions please make sure EnergyPlus v8.0 is installed per the instructions below.

EnergyPlus v8.0 (only to be downloaded when installing CBECC-Com v1d): Installation files may be downloaded from the US Department of Energy (DOE) website:
http://apps1.eere.energy.gov/buildings/energyplus/energyPlus_download.cfm?previous

Note: EnergyPlus v8.1 is the latest version; however, CBECC-Com uses EnergyPlus v8.0. In order to download v8.0, you are required to set up a user account and will receive a password to use during the installation process. Be sure to download v8.0 and keep a record of your installation password.

Note: After logging in, you are taken to the main download page for the current version of EnergyPlus. On that page, **click** on the link that says "Download latest version of EnergyPlus" and then **select** Windows 8.0.0 008 for Windows 32-bit or 64-bit (depending upon your computer specification) to download. See the screenshot below.


Download Previous Versions of EnergyPlus - Accept License Agreement
Please choose the appropriate version and platform and accept the license agreement below to get the software.
Download latest version of EnergyPlus
32-Bit Versus 64-Bit
EnergyPlus is available in 32-bit and 64-bit versions. Only download the 64-bit version if you know you have a 64-bit version of the Windows (WinXP-64, Vista-64, Windows7-64) or Linux operating system. For Macintosh, an Intel Mac running version 10.7 or higher of Mac OS X is required. The 32-bit version of EnergyPlus will run on both 64 and 32-bit computers. The 64-bit version requires a 64-bit computer.
Windows
32-Bit
Windows 7.0.0 036 (EXE 80.3 MB)
Windows 7.1.0 012 (EXE 87.17)
Windows 7.2.0 006 (EXE 90.9 MB)
Windows 8.0.0 007 (EXE 92.7)
Windows 8.0.0 008 (EXE 92.7)
64-Bit
Windows 64 bit 7.0.0 036 (EXE 81.4 MB)
Windows 64 bit 7.1.0 012 (EXE 81.4 MB)
Windows 64 bit 7.2.0 006 (EXE 92 MB)
Windows 64 bit 8.0.0 007 (EXE 93.7)
Windows 64 bit 8.0.0 008 (EXE 93.7)
Macintosh
32-Bit
Macintosh 7.0.0 036 (DMG 69.1 MB)
Macintosh 7.1.0 012 (DMG 69.1 MB)
Macintosh 7.2.0 006 (DMG 76.8 MB)
64-Bit
Macintosh 64 bit 7.0.0 036 (DMG 69.4 MB)
Macintosh 64 bit 7.1.0 012 (DMG 69.4 MB)
Macintosh 64 bit 7.2.0 006 (DMG 77.7 MB)
Macintosh 64 bit 8.0.0 008 (DMG 79.8)
Macintosh 64 bit 8.0.0 007 (DMG 77.7)
Linux
32-Bit
Linux 7.0.0 036 (SH 88.2 MB)
Linux 7.1.0 012 (SH 88.2 MB)
Linux 7.2.0 006 (SH 97.6 MB)
Linux 8.0.0 007 (SH 100.6)
Linux 8.0.0 008 (SH 100.7)
64-Bit
Linux 64 bit 7.0.0 036 (SH 89.7 MB)
Linux 64 bit 7.1.0 012 (SH 89.7 MB)
Linux 64 bit 7.2.0 006 (SH 98.7 MB)
Linux 64 bit 8.0.0 007 (SH 101.6)
Linux 64 bit 8.0.0 008 (SH 101.7)

OpenStudio Translator: No additional download is required. This functionality is included in the CBECC-Com installation.

Creating Building Geometry Using the OpenStudio Plug-In for Trimble SketchUp

The OpenStudio plug-in for SketchUp allows users to create a representation of a building's geometry. The tool should be used for the following steps:

- Draw the building's floor plans, and generate all *Building Stories* and *Spaces* in the building.
- Draw all *Surfaces* (e.g., walls, floors, roofs) and sub-surfaces (e.g., windows, doors, skylights) and verify that they are accurately assigned as exterior or interior surfaces.
- Assign all *Spaces* to *Thermal Zones.*

- Additionally, you may wish to give the spaces and zones meaningful names (e.g., as they appear on the building floor plans).

Detailed tutorials for creating building geometry can be found at the following link:

http://openstudio.nrel.gov/sketchup-plug-tutorials

Figure 6 below shows an example of a two story building created with the OpenStudio plug-in.

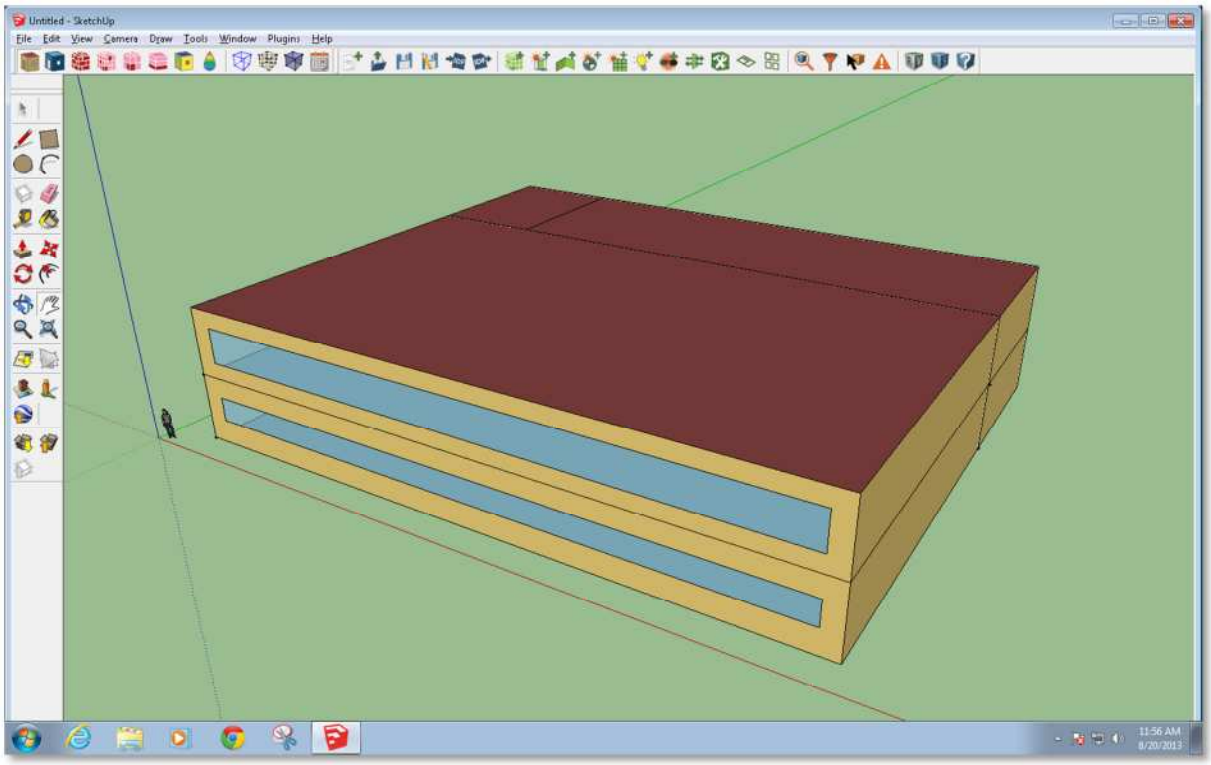


Figure 6 – Example Building Created With the OpenStudio Plug-In

Exporting the Model to SDD XML

Once the building geometry has been created, export to SDD XML. The export function is located in the **Plugins** menu (refer to Figure 7 below). To access this menu, click:

Plugins→Export→Export SDD Model

Save the XML file to your project folder or other desired location.

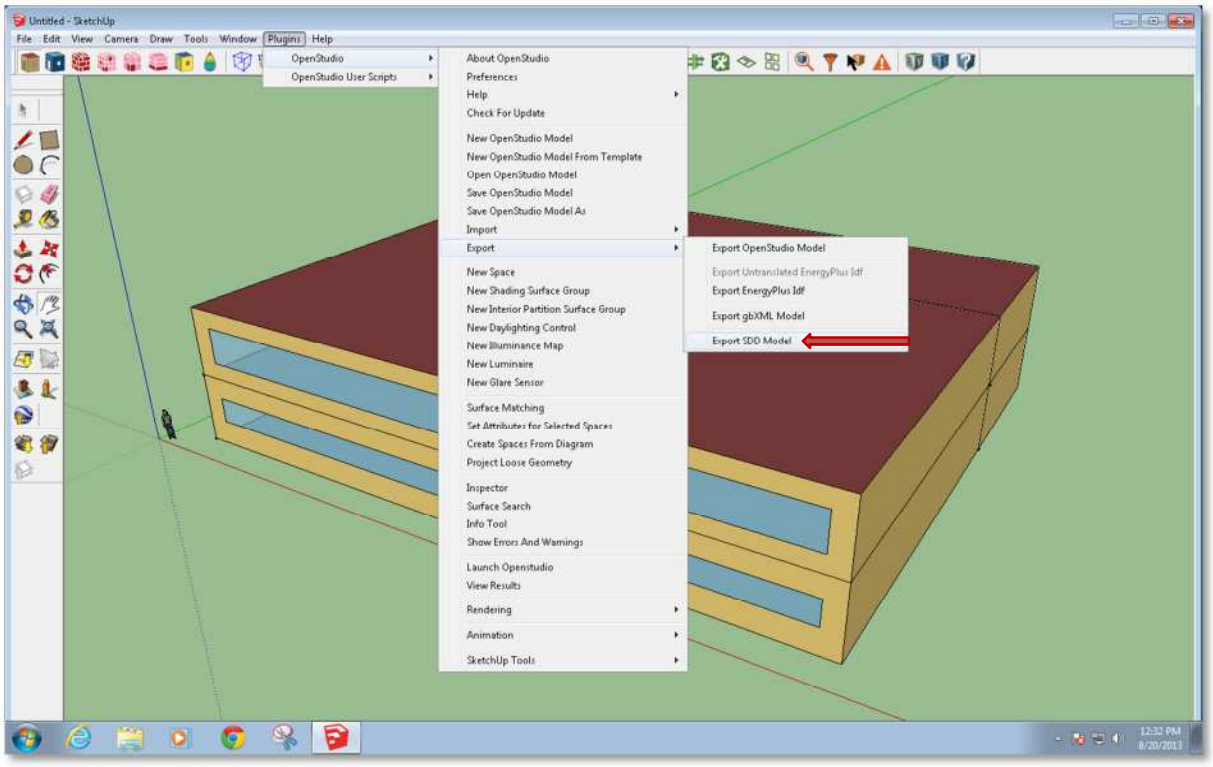


Figure 7 – Exporting the Model to SDD XML

Starting a New Project

When CBECC-Com is first started, a dialog box appears with four options:

1. Open Recent Project
2. Select an Existing Project to Open
3. Create a New Simplified Geometry Project
4. Start with a Blank Project

One of the first two options must be used when working on a *Detailed Geometry* project. The **Open Recent Project** option automatically selects the project that was being worked on the last time CBECC-Com was open. The **Select an Existing Project to Open** option requires browsing to the desired project. If **Select an Existing Project to Open** is selected, the default file type in the browser window is a .cibd file. However, this can be changed to .xml, allowing the user to open an SDD XML file.

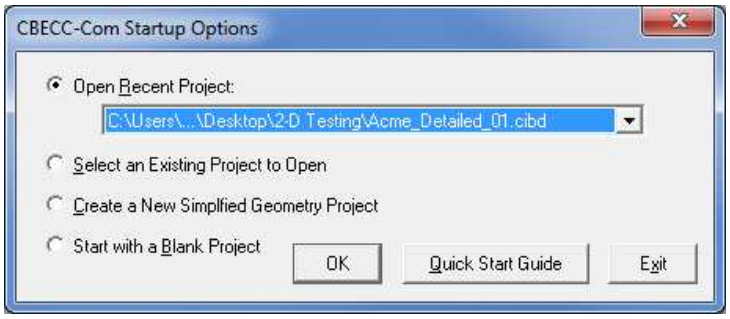
The second two options are essentially the same and are used when using the *Simplified Geometry* approach. The **Create a New Simplified Geometry Project** option automatically walks the user through to setting up the initial project parameters and building elements whereas the **Start with a Blank Project** starts a new project with a blank template.

Users can take either approach to modeling their project however the preferred workflow is to use the *Detailed Geometry* approach using OpenStudio, creating building model geometry using SketchUp with the OpenStudio plugin. OpenStudio includes an option for exporting an SDD file, which CBECC-Com can then open. The *Simplified Geometry* approach is recommended for simpler buildings since this approach comes with certain limitations which could prevent the project from getting credit for certain efficiency measures included in the design.

For more information on the recommended workflow, please view the tutorial videos at http://bees.archenergy.com/faq.html.

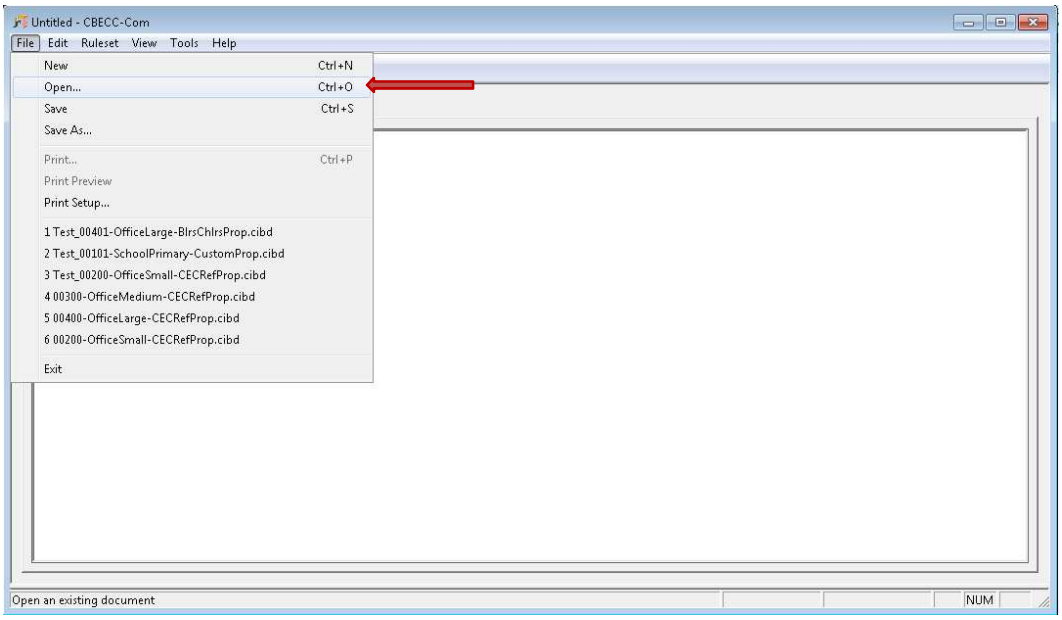
Importing Geometry into the CBECC-Com User Interface

Launch CBECC-Com. On launch, a window presents four startup options.

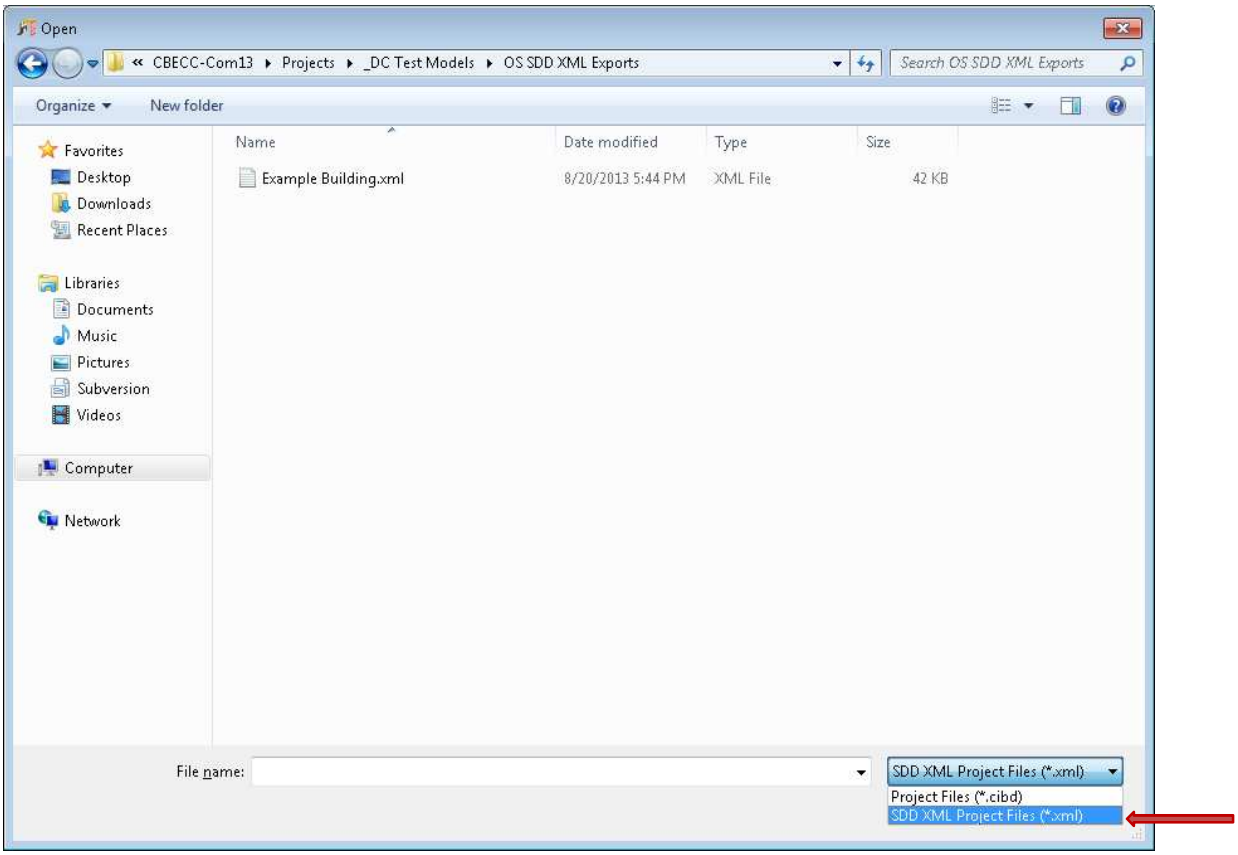


Click the radio button to **Select an Existing Project to Open.**

Alternatively, if CBECC is already open, then go to the **File menu and click Open…**

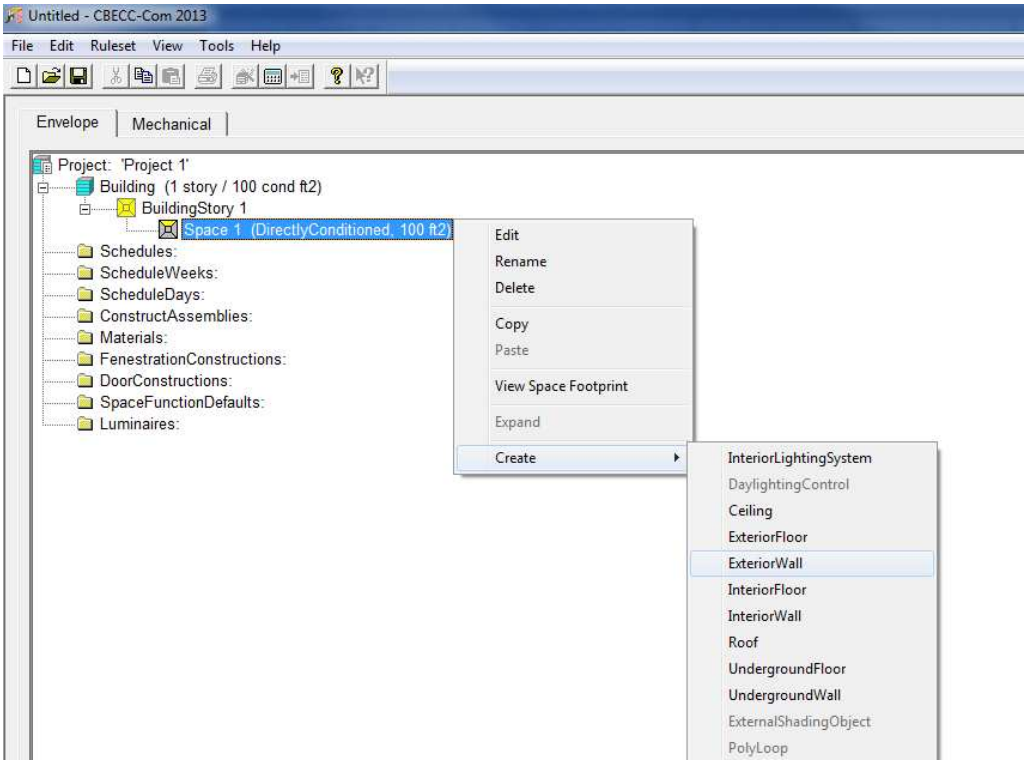


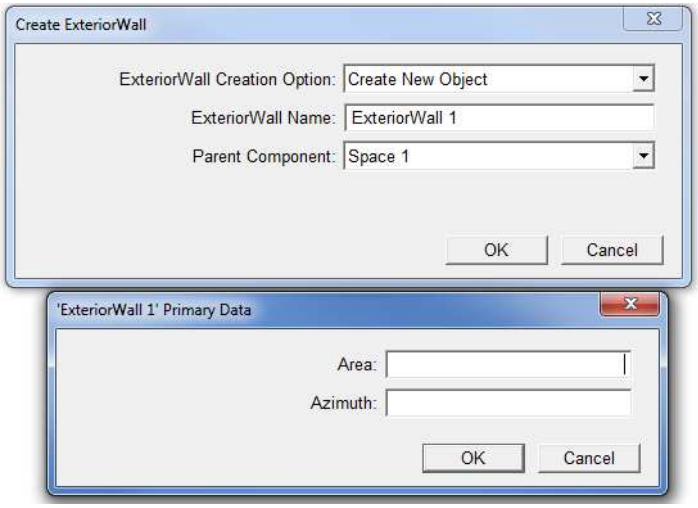
Go to the folder where you saved the SDD XML file. Select the file type **SDD XML Project Files.** In the example below, see the drop-down list in the lower right corner. Click **Open** to import the file.



Simplified Geometry - Creating Building Geometry Using the CBECC-Com Interface

The *Simplified Geometry* option within CBECC-Com GUI allows users to create a building model without specifying coordinates in space for various building surfaces such as walls, roofs, fenestrations etc. The GUI allows a user to create various building objects (surfaces) and their child objects by defining the characteristics that define that object in space without having to use any drawing tools such as SketchUp (with the OpenStudio plug-in). The inputs to define the various building envelope components require the user to have available detailed take-offs from the construction drawings for each of those components to be able to input into the building model. For example a wall will be defined using area and azimuth, whereas a roof will be defined using area, azimuth and tilt.





The data used in the *Simplified Geometry* approach does not define the spatial relationships between the various surfaces which can found in the building geometry generated using drawing tools such as SketchUp with the OpenStudio plug-in (*Detailed Geometry* approach). Thus using the *Simplified* approach has inherent limitations for compliance analysis.

Limitations of using *Simplified Geometry* approach include not being able to model or take credit for certain features such as daylighting, daylighting controls and shading from shading devices such as overhangs, louvers etc. Since no daylighting can be modeled using the *Simplified* approach, projects submitting compliance documents for plan check need to make sure that their project meets all the mandatory and prescriptive daylighting requirements.

Please note that CBECC-Com does not include the ability to mix the modeling inputs for building geometry using the *Simplified* and *Detailed Geometry* approaches, so project teams must choose one of the two modeling paths when doing compliance analysis.

The CBECC-Com User Interface

Once the building geometry is input, the model information is presented in the CBECC-Com user interface. The data is organized in a tree structure that is defined by the Standards Data Dictionary (SDD) data model.

The highest level of the tree is the *Project*. The next level (the "child" of the *Project*) is the *Building*. Beneath the *Building* level are two main categories of data: Envelope and Mechanical.

The Envelope data encompasses the geometry of the building, the properties of the building's construction materials, the spaces in the building, and the thermal gains within each space.

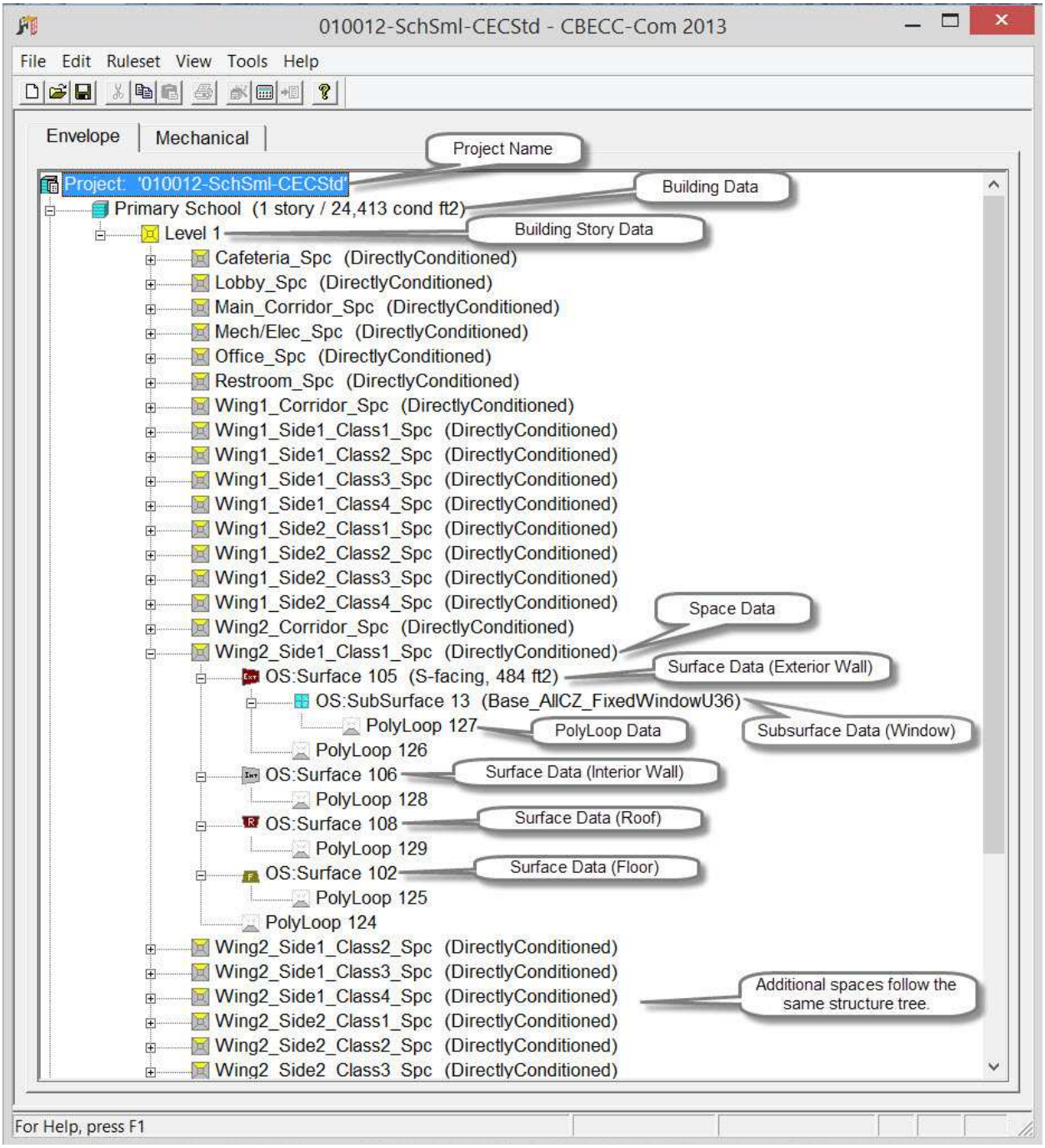
The Mechanical data encompasses all of the air and water systems in the building, which zones they serve, and how they operate.

The Envelope and Mechanical data are input on two separate tabs in the user interface. A detailed summary of the model hierarchy on each tab is presented below. Each item on the model tree is an editable object. A user can edit an object's properties (in an input screen) by double clicking it with the mouse, or right-clicking **Edit** on the main menu. Additionally, a user can create child objects by right-clicking the parent and selecting **Create,** and then clicking the desired child object.

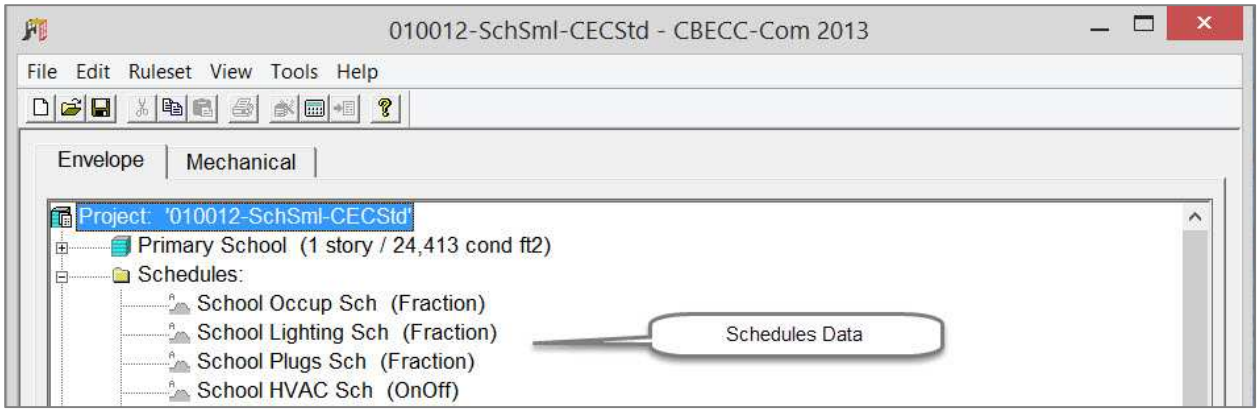
Tip: Input Units
The input screens show the units for numerical inputs. For example, boiler efficiency is input as a decimal like 0.8, not as a percent (%) like 80. The latter gives heating energy 100 times too big.

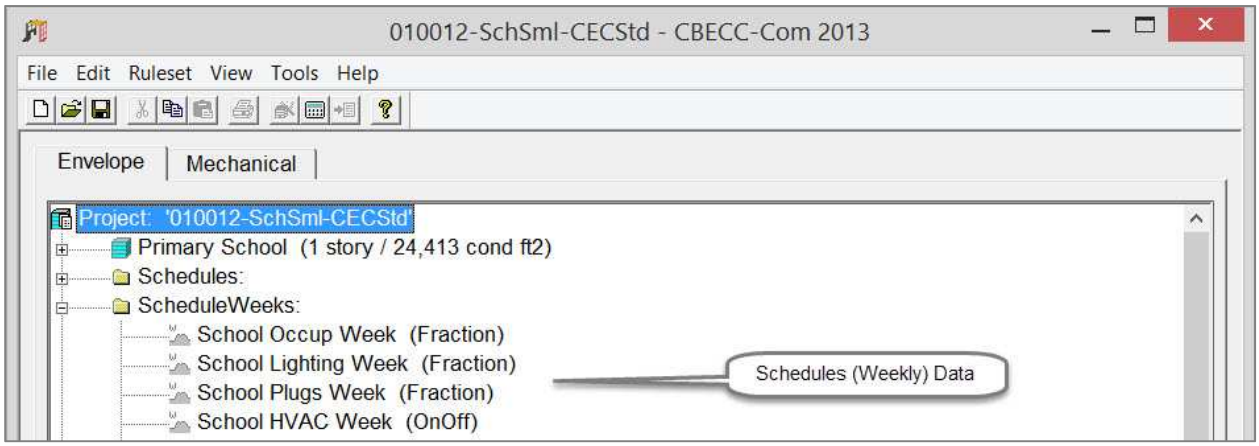
For a detailed description of the software menus and toolbar, please refer to the CBECC-Com_QuickStartGuide.pdf that can be accessed on the **Help** menu by clicking **Quick Start Guide**.

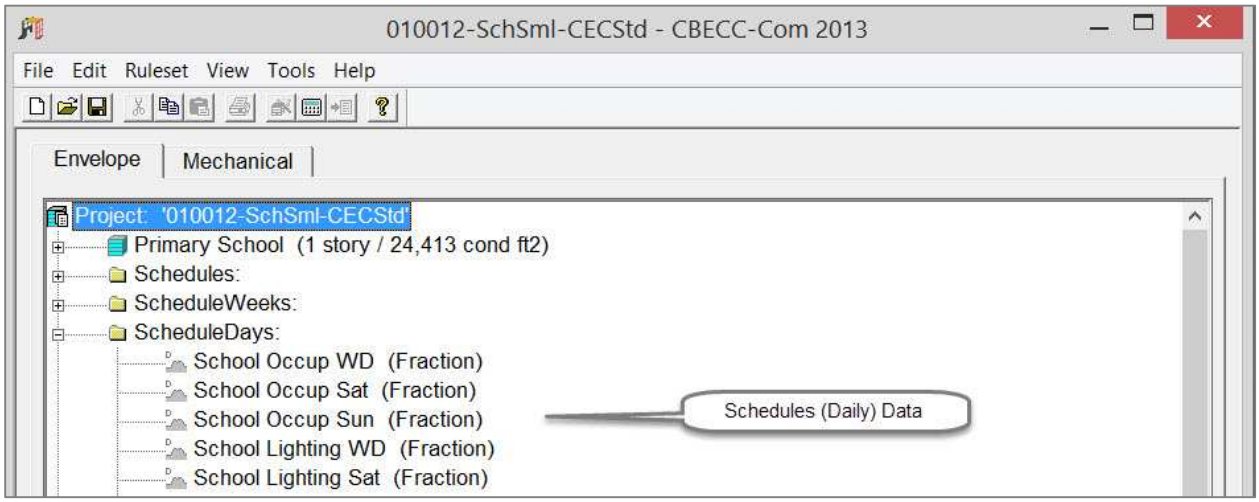
Organization of the Envelope Tab



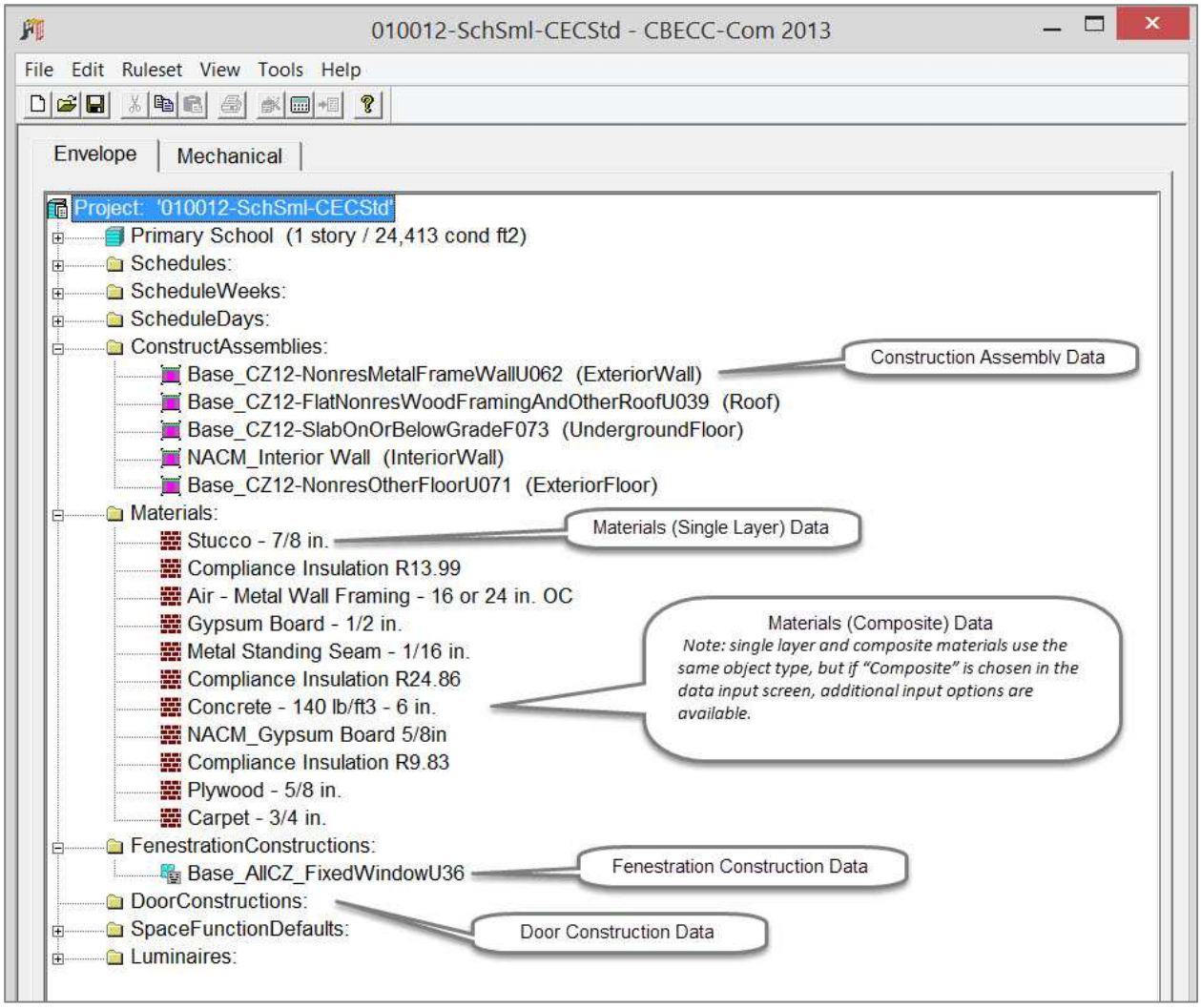
Organization of the Envelope Tab (continued)



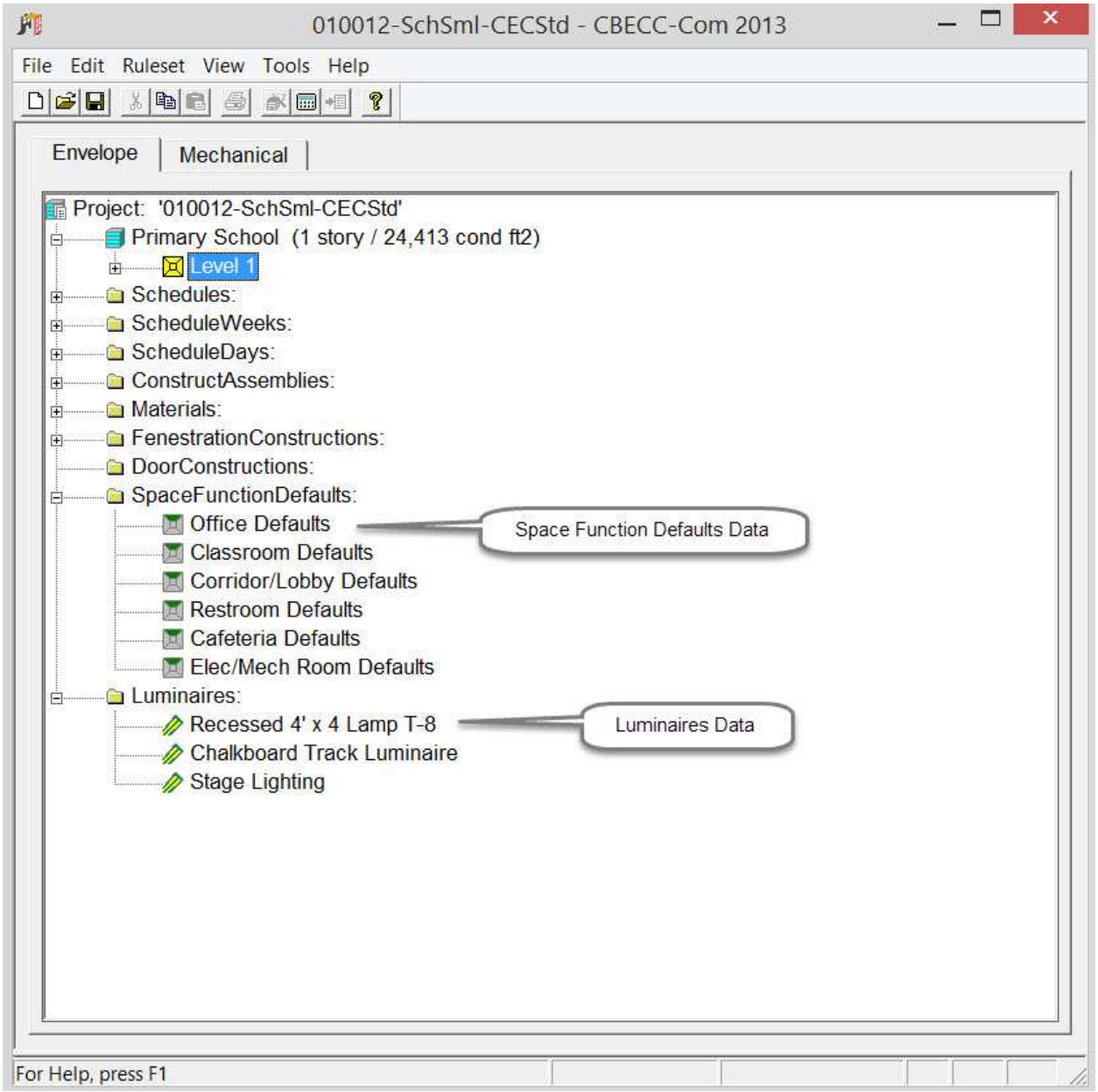




Organization of the Envelope Tab (continued)



Organization of the Envelope Tab (continued)

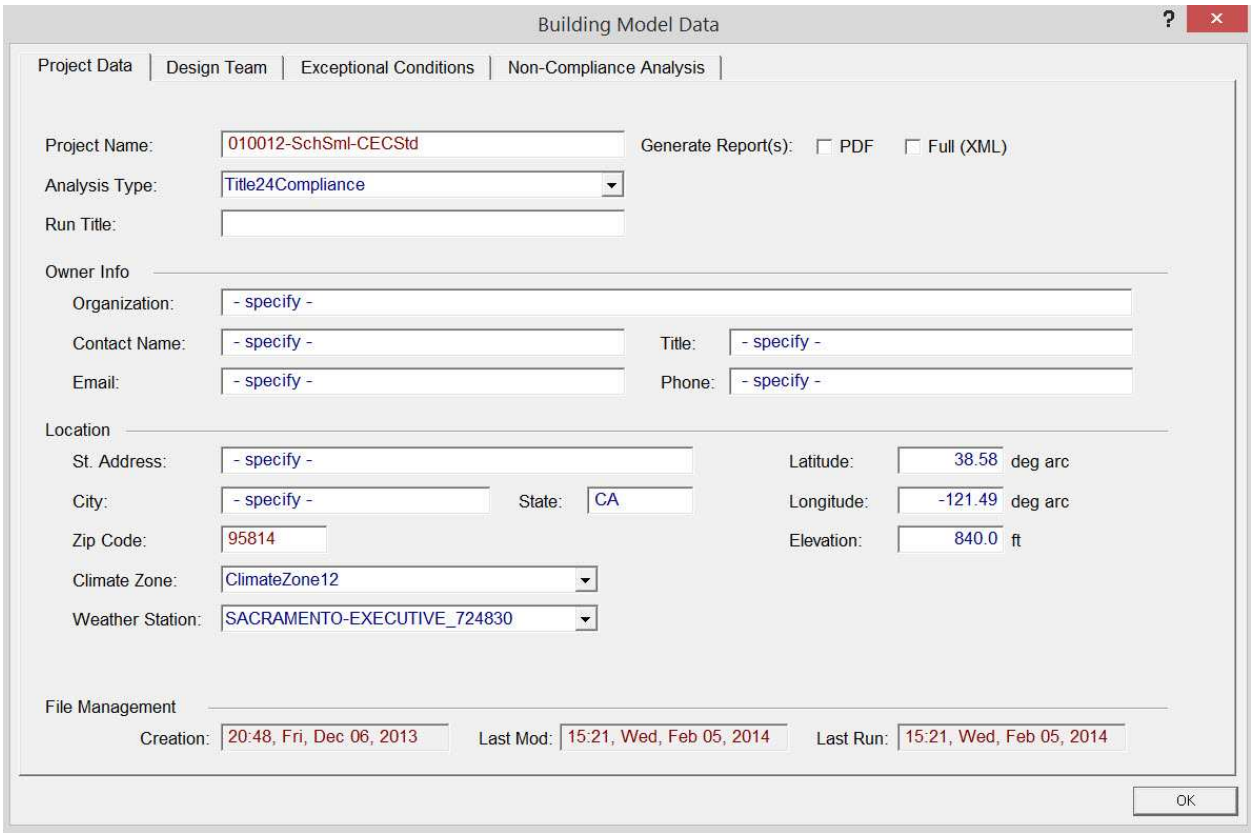


Envelope Input Screen Details

The Envelope Input Screen contains four tabs: Project Data, Design Team, Exceptional Conditions, and Non-Compliance Analysis. See each screen and its input information below.

Project Data Screen (Project Data Tab)

To access this screen, in the **Envelope** tab double click on the Project name.



Input summary for the Project Data screen:

- **Project Name**: Name used for the project, if one is applicable.
- **Analysis Type**: Type of analysis to be performed.
- **Run Title**: Title that appears on reports to identify this analysis (input is optional).

Owner Info section

- **Organization**: Building owning organization.
- **Contact Name**: Building owning organization primary contact name.
- **Title**: Building owning organization primary contact title.
- **Email**: Building owning organization primary contact email.
- **Phone**: Building owning organization primary contact phone.

Location section

- **St. Address:** Street address where the project is located.
- **City**: City where the project is located.
- **State:** State where the project is located.

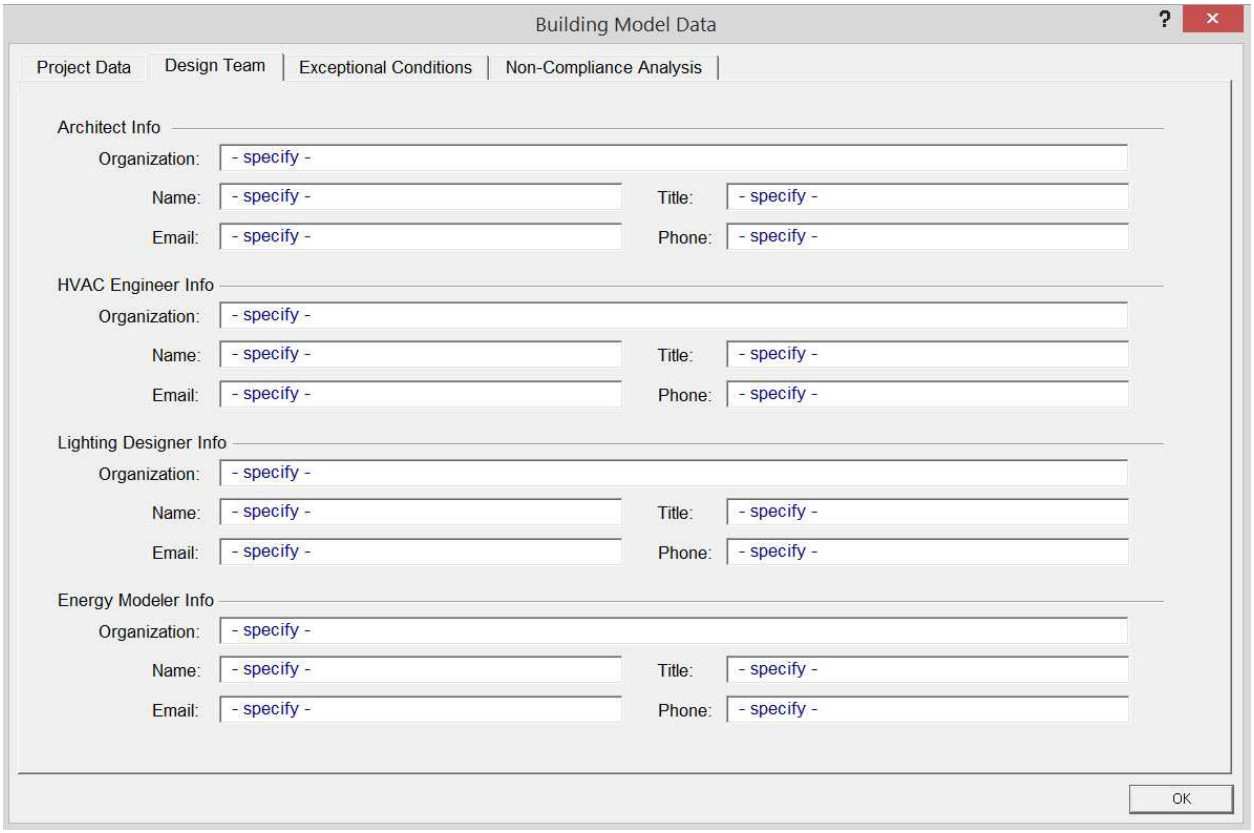
- **Zip Code**: ZIP code where the project is located. Location and Weather File date defaulted based on this value.
- **Climate Zone**: Climate zone.
- **Weather Station:** California weather station.
- **Latitude**: Building latitude.
- **Longitude**: Building longitude.
- **Elevation**: Building elevation.

File Management section

- **Creation**: The time and date of creation of the project file.
- **Last Mod**: The time and date of the last revision of the project file.
- **Last Run**: The time and date of the last analysis run of the project file.

Project Data Screen (Design Team Tab)

To access this screen, in the **Envelope** tab double click on the Project name and then click the **Design Team** tab.


Building Model Data
Project Data
Design Team
Exceptional Conditions
Non-Compliance Analysis
Architect Info
Organization: - specify -
Name: - specify - Title: - specify -
Email: - specify - Phone: - specify -
HVAC Engineer Info
Organization: - specify -
Name: - specify - Title: - specify -
Email: - specify - Phone: - specify -
Lighting Designer Info
Organization: - specify -
Name: - specify - Title: - specify -
Email: - specify - Phone: - specify -
Energy Modeler Info
Organization: - specify -
Name: - specify - Title: - specify -
Email: - specify - Phone: - specify -
OK

Input summary for the **Design Team** tab:

Architect Info section

- **Organization**: Architect Organization (input is optional).
- **Name**: Architect primary contact name (input is optional).
- **Title**: Architect primary contact title (input is optional).
- **Email:** Architect primary contact email (input is optional).
- **Phone**: Architect primary contact phone (input is optional).

HVAC Engineer Info section

- **Organization**: HVAC Engineer Organization (input is optional).
- **Name:** HVAC Engineer primary contact name (input is optional).
- **Title:** HVAC Engineer primary contact title (input is optional).
- **Email**: HVAC Engineer primary contact email (input is optional).
- **Phone**: HVAC Engineer primary contact phone (input is optional).

Lighting Designer Info section

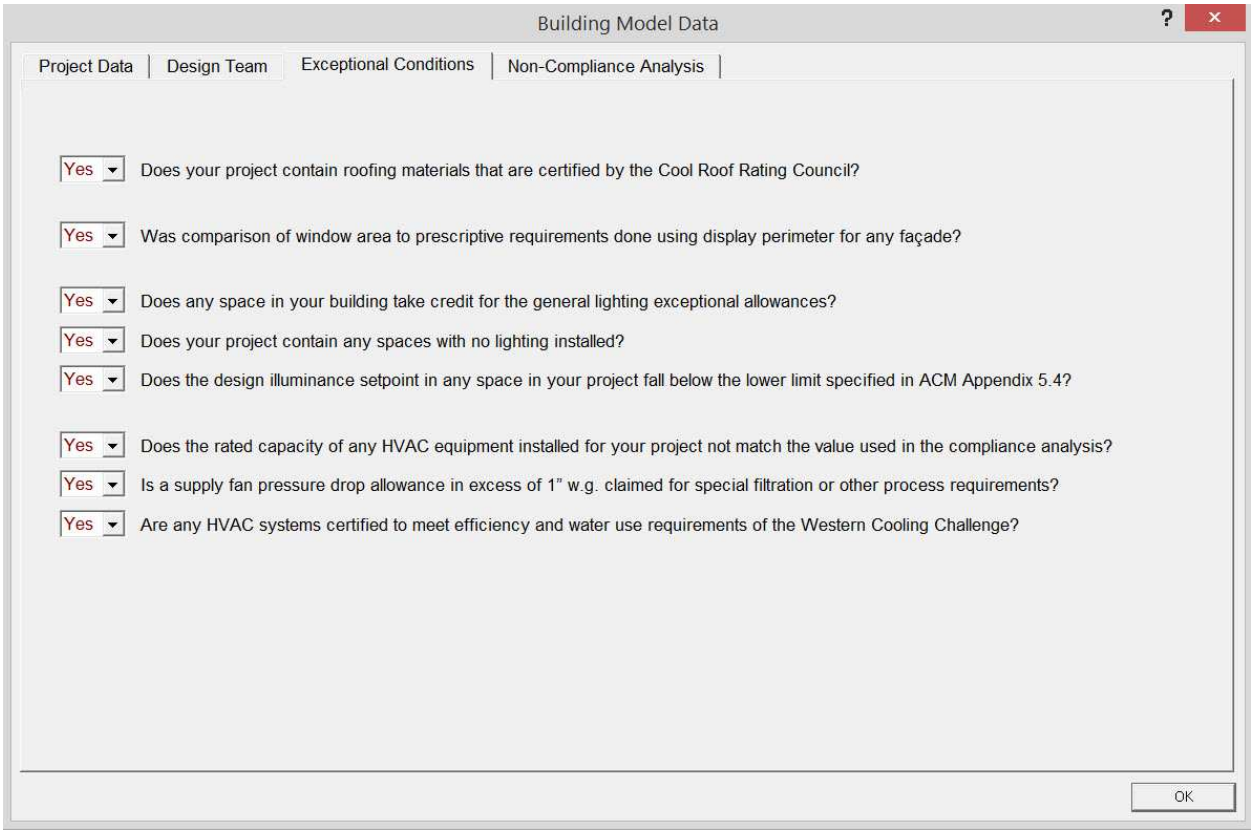
- **Organization**: Lighting Designer Organization (input is optional).
- **Name**: Lighting Designer primary contact name (input is optional).
- **Title**: Lighting Designer primary contact title (input is optional).
- **Email**: Lighting Designer primary contact email (input is optional).
- **Phone:** Lighting Designer primary contact phone (input is optional).

Energy Modeler Info section

- **Organization:** Energy Modeler Organization (input is optional).
- **Name**: Energy Modeler primary contact name (input is optional).
- **Title:** Energy Modeler primary contact title (input is optional).
- **Email**: Energy Modeler primary contact email (input is optional).
- **Phone:** Energy Modeler primary contact phone (input is optional).

Project Data Screen (Exceptional Conditions Tab)

To access this screen, in the **Envelope** tab double click on the Project name and then click the **Exceptional Conditions** tab.


Building Model Data
Project Data
Design Team
Exceptional Conditions
Non-Compliance Analysis
Yes
Does your project contain roofing materials that are certified by the Cool Roof Rating Council?
Yes
Was comparison of window area to prescriptive requirements done using display perimeter for any façade?
Yes
Does any space in your building take credit for the general lighting exceptional allowances?
Yes
Does your project contain any spaces with no lighting installed?
Yes
Does the design illuminance setpoint in any space in your project fall below the lower limit specified in ACM Appendix 5.4?
Yes
Does the rated capacity of any HVAC equipment installed for your project not match the value used in the compliance analysis?
Yes
Is a supply fan pressure drop allowance in excess of 1" w.g. claimed for special filtration or other process requirements?
Yes
Are any HVAC systems certified to meet efficiency and water use requirements of the Western Cooling Challenge?
OK

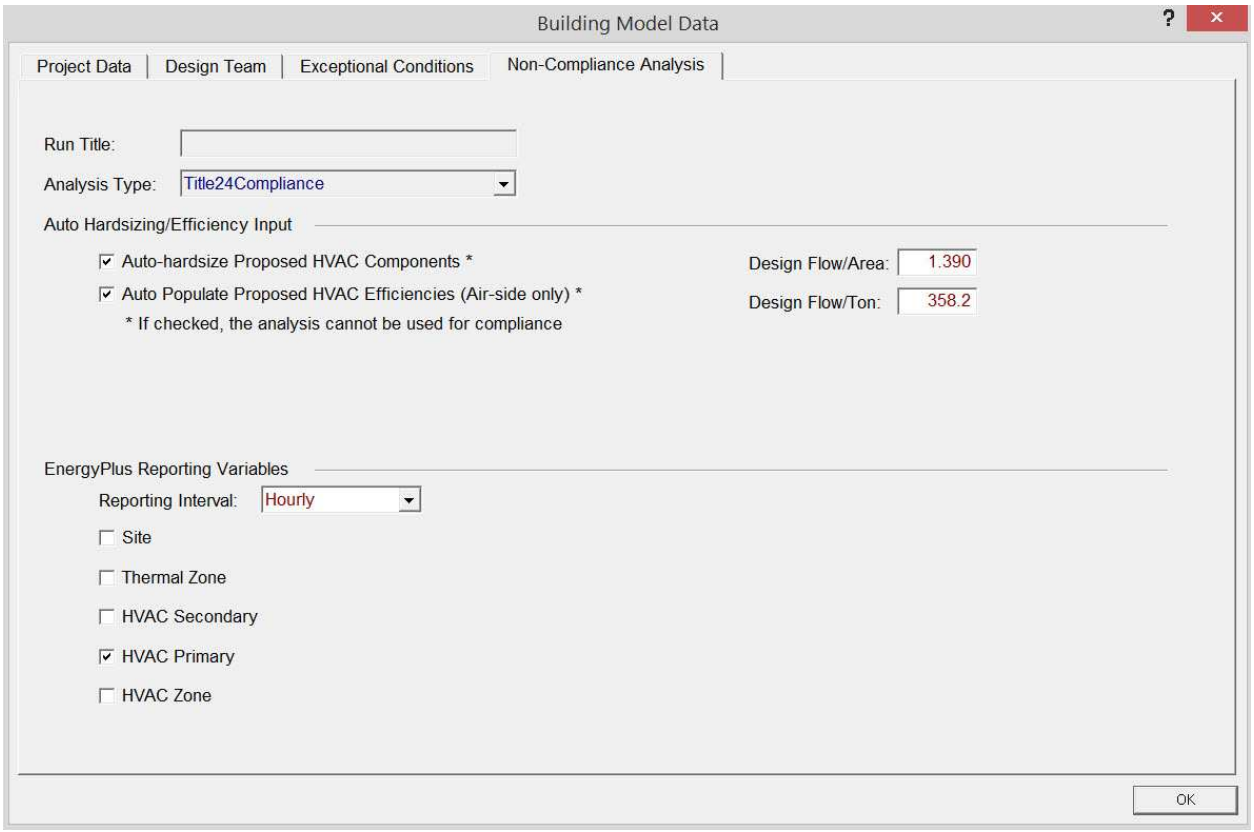
Input summary for the **Exceptional Conditions** tab:

It is required that all of the options on this screen are selected **Yes** or **No**, as appropriate. If any are left blank, an error will result.

If any of the exceptional conditions apply to your project, mark that item **Yes**. The compliance forms will include guidance for the code reviewer to check the exceptional conditions for compliance.

Project Data Screen (Non-Compliance Analysis Tab)

To access this screen, in the **Envelope** tab double click on the Project name and then click the **Non-Compliance Analysis** tab. This tab provides inputs for use in building analysis other than compliance.



Input summary for the Non-Compliance Analysis tab:

Auto Hardsizing/Efficiency Input

- **Auto-hardsize Proposed HVAC Components**
- **Auto Populate Proposed HVAC Efficiencies (Air-side only)**
- **Design Flow/Area**
- **Design Flow/Ton**

CBECC-Com requires that user model HVAC equipment have all capacity and efficiency inputs entered. For analysis that is not intended for compliance, these inputs may not be known. These inputs allow the user to activate rules of thumb to provide required equipment capacities, and to tailor these inputs if desired. However, if the two boxes are checked, the run results cannot be used to show compliance with the energy code.

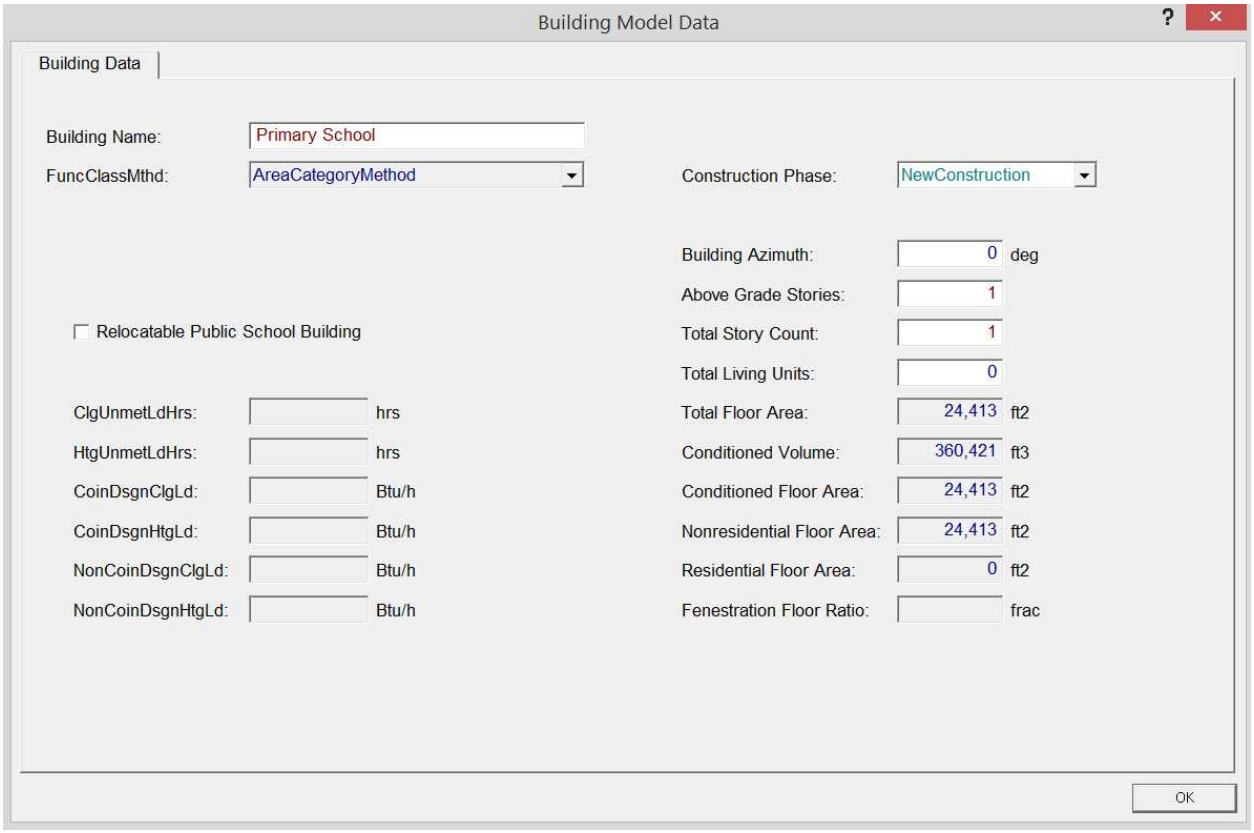
EnergyPlus Reporting Variables

- **Site**
- **Thermal Zone**
- **HVAC Secondary**
- **HVAC Primary**
- **HVAC Zone**

These check boxes activate writing of designated output variables to special report files. These output files are primarily intended for debugging of the rules and EnergyPlus translations, but may be useful for simulation debugging as well. These check boxes, unlike the previous ones on this tab, do not disqualify the run results from being used to show code compliance.

Building Data Screen

To access this screen, under the Project name double click on the Building Data.



Input summary for the Building Data screen:

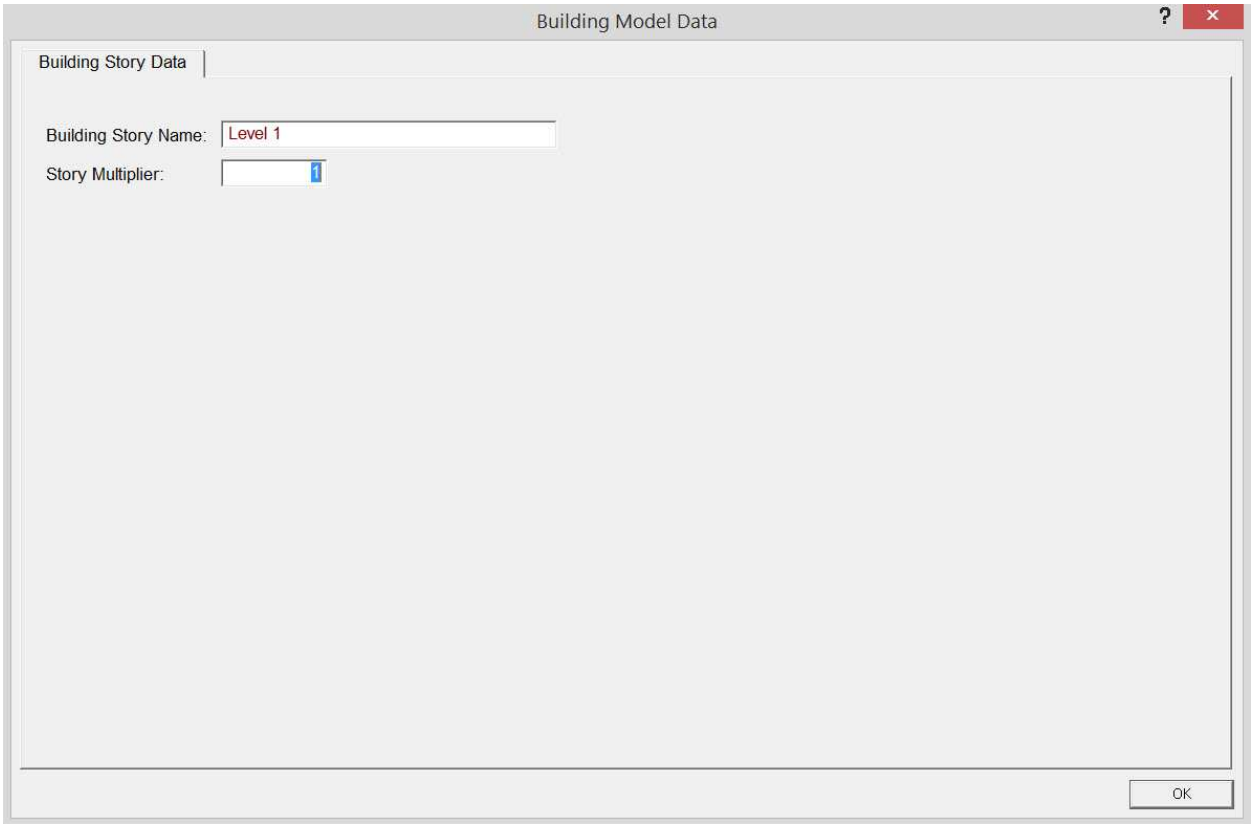
- **Building Name**: The name or description used to identify the building.
  - **FuncClassMthd:** The method of specifying functional area types. Identifies whether functional area types will be assigned using the Complete Building Method or the Area Category Method.

    At least 80 percent of the building area is required to be of the selected occupancy.
  - **ClgUnmetLdHrs:** The number of hours during the year when the space temperature is greater than the cooling setpoint temperature. The cooling unmet load hours are used to determine if resizing is required.
  - **HtgUnmetLdHrs:** The number of hours during the year when the space temperature is below the heating setpoint temperature. The heating unmet load hours are used to determine if resizing is required.
  - **CoinDsgnClgLd:** Coincident Design Cooling Load.
  - **CoinDsgnHtgLd:** Coincident Design Heating Load.
  - **NonCoinDsgnClgLd:** Sum of all Thermal Zone Design Cooling Loads.
  - **NonCoinDsgnHtgLd:** Sum of all Thermal Zone Design Heating Loads.
  - **Construction Phase:** A list categorizing the construction phase of the project. Options are **Addition, Alteration, NewConstruction** and **Repair.**

- **Building Azimuth**: The angle between the model Y axis and True North, measured clockwise from the Y axis from Degree.
- **Above Grade Stories:** The number of above-grade building stories. This property is one determining factor for the baseline HVAC system type. A “floor” is considered a “Habitable Story,” defined in the Standards as a story that is at least 50 percent above grade.
- **Total Story Count:** The total number of stories in a building. Includes both above grade stories and any below grade stories.
- **Total Living Units:** The number of independent residences within the building.
- **Total Floor Area:** The total floor area (conditioned and unconditioned) of the building.
- **Conditioned Volume**: The total building conditioned volume.
- **Conditioned Floor Area:** The total building conditioned floor area.
- **Nonresidential Floor Area**: The total building nonresidential (conditioned) floor area.
- **Residential Floor Area:** The total building residential (conditioned) floor area.
- **Fenestration Floor Ratio:** The area of fenestrations per floor area.

Building Story Data Screen

To access this screen, under Building Data double click on the Building Story Data.

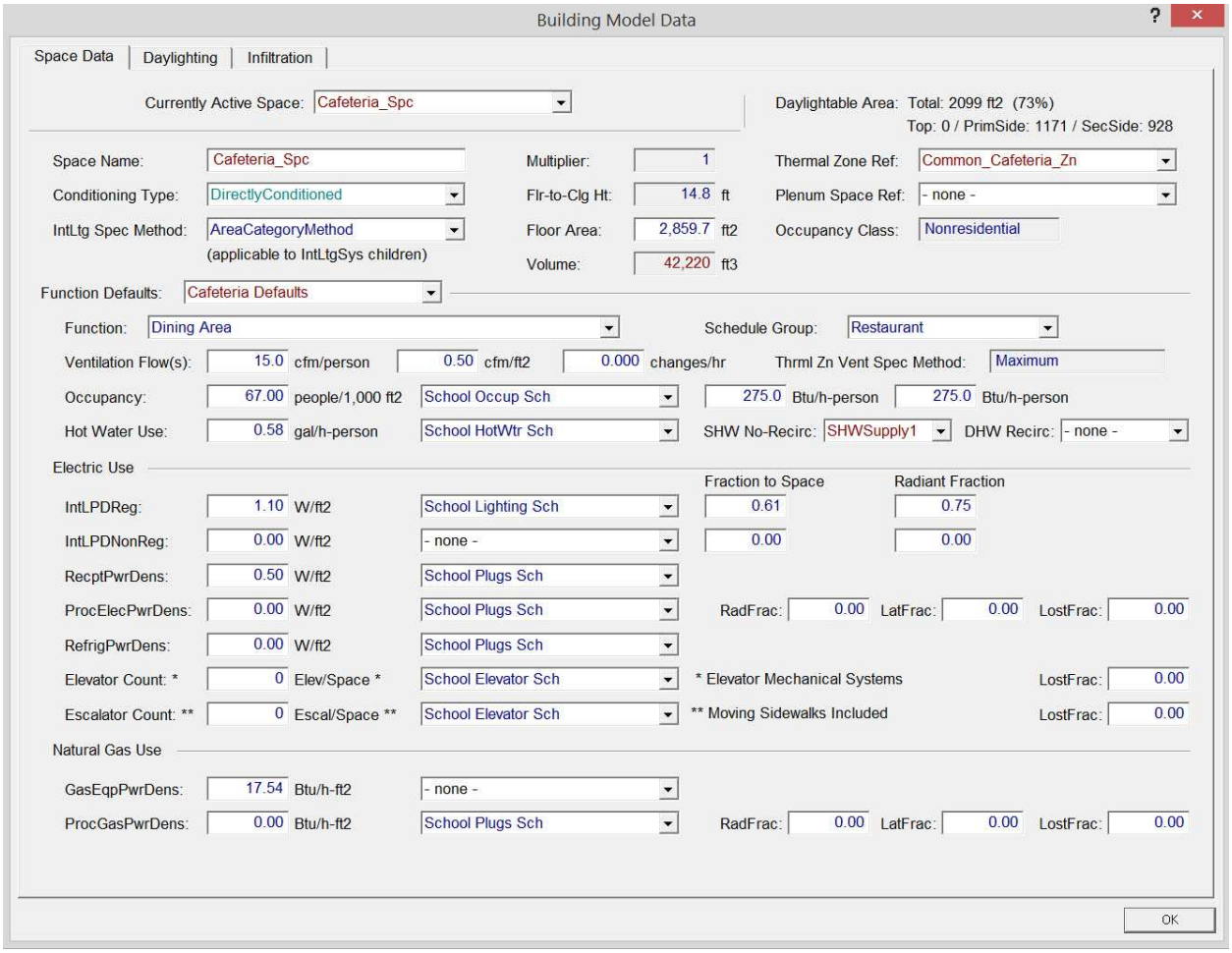


Input summary for the Building Story Data screen:

- **Building Story Name**: The name or description used to identify the building story.
- **Story Multiplier**: Story multiplier.
  This property is user-specified for quickly multiplying the spaces and related thermal zones on each building floor.

Space Data Screen (Space Data Tab)

To access this screen, under Building Story Data double click Space Data.


Building Model Data
Space Data
Daylighting
Infiltration
Currently Active Space: Cafeteria_Spc
Daylightable Area: Total: 2099 ft2 (73%)
Top: 0 / PrimSide: 1171 / SecSide: 928
Space Name: Cafeteria_Spc
Multiplier: 1
Thermal Zone Ref: Common_Cafeteria_Zn
Conditioning Type: DirectlyConditioned
Flr-to-Clg Ht: 14.8 ft
Plenum Space Ref: - none -
IntLtg Spec Method: AreaCategoryMethod
(applicable to IntLtgSys children)
Floor Area: 2,859.7 ft2
Occupancy Class: Nonresidential
Volume: 42,220 ft3
Function Defaults: Cafeteria Defaults
Function: Dining Area
Schedule Group: Restaurant
Ventilation Flow(s): 15.0 cfm/person 0.50 cfm/ft2 0.000 changes/hr
Thrml Zn Vent Spec Method: Maximum
Occupancy: 67.00 people/1,000 ft2 School Occup Sch 275.0 Btu/h-person 275.0 Btu/h-person
Hot Water Use: 0.58 gal/h-person School HotWtr Sch
SHW No-Recirc: SHWSupply1
DHW Recirc: - none -
Electric Use
Fraction to Space
Radiant Fraction
IntLPDReg: 1.10 W/ft2 School Lighting Sch 0.61 0.75
IntLPDNonReg: 0.00 W/ft2 - none - 0.00 0.00
RecptPwrDens: 0.50 W/ft2 School Plugs Sch
ProcElecPwrDens: 0.00 W/ft2 School Plugs Sch RadFrac: 0.00 LatFrac: 0.00 LostFrac: 0.00
RefrigPwrDens: 0.00 W/ft2 School Plugs Sch
Elevator Count: * 0 Elev/Space * School Elevator Sch * Elevator Mechanical Systems LostFrac: 0.00
Escalator Count: ** 0 Escal/Space ** School Elevator Sch ** Moving Sidewalks Included LostFrac: 0.00
Natural Gas Use
GasEqpPwrDens: 17.54 Btu/h-ft2 - none -
ProcGasPwrDens: 0.00 Btu/h-ft2 School Plugs Sch RadFrac: 0.00 LatFrac: 0.00 LostFrac: 0.00
OK

Input summary for the Space Data screen (**Space Data** tab):

- **Currently Active Space**: The name of the currently selected space.
- **Space Name**: The name or description used to identify the space.
- **Conditioning Type**: One of a list of categories that characterize the type of conditioning for a space.
- **IntLtg Spec Method**: The method for selecting baseline lighting and other loads for a space.
- **Multiplier**: The number of duplicate spaces. This value is used for reference only to default the multipliers from thermal zone within the data model.
- **Flr-to-Clg Ht**: The measurement of height from the top surface of the floor to the bottom surface of the ceiling in an enclosed space.
- **Floor Area**: Used as the measurement of area of the floor that is part of a building object and is calculated by multiplying the length dimension by the width dimension.
- **Volume**: The measurement of space or object calculated by multiplying the three dimensions of the space: length, width, and height.
- **Thermal Zone Ref**: This is a reference to the thermal zone that serves a given space.
- **Plenum Space Ref**: This is a reference to the plenum space that serves a given space.

- **Occupancy Class**: The occupancy classification of the space.
- **Function Defaults**: Reference to a unique SpaceFunctionDefaults object name.
- **Function**: The area category occupancy type from Nonresidential Appendix 5.4A.
- **Schedule Group**: A type specifying occupancy categories used to determine schedules.
- **Ventilation Flow(s):** The amount of outside air provided to a space during occupied hours divided by the floor area of that space.
- **Occupancy**: The areal density of people associated with a space expressed in people per 1000 square feet.
- **Hot Water Use**: The amount of energy required to provide hot water for each person in a space during occupied hours.
- **SHW No-Recirc**: The solar hot water loop coming into the space.
- **DHW Recirc**: The domestic hot water loop coming into the space.

Electric Use section

- **IntPDReg**: Total regulated connected lighting power density for all interior lighting systems in a Space. This includes the loads for lamps and ballasts.
- Schedules (drop-down box): Reference to a schedule that describes interior lighting use.
- **Fraction to Space:** Fraction of regulated interior lighting heat gain going to space air.
- **Radiant Fraction**: Fraction of regulated interior lighting radiant heat gain going to space surfaces.
- **IntPDNonReg**: Total non-regulated connected lighting power density for all interior lighting systems in a Space. This includes the loads for lamps and ballasts.
- Schedules drop-down box: Reference to a schedule that describes the fraction of lighting use on an hourly basis.
- **Fraction to Space**: Fraction of non-regulated interior lighting heat gain going to space air.
- **Radiant Fraction**: Fraction of non-regulated interior lighting radiant heat gain going to space surfaces.
- **RecptPwrDens**: The usage of electrical devices plugged into receptacles in a space based on the occupancy type.
- **Schedules** (drop-down box): Reference to a schedule that describes the fraction of receptacle use on an hourly basis.
- **ProcElecPwrDens**: Process electrical power density resulting from an activity or treatment not related to the space conditioning, lighting, service water heating, or ventilating of a building as it relates to human occupancy. Process load may include sensible and/or latent components. For data centers this includes transformers, UPS, PDU, server fans, power supplies, etc.
- **Schedules** (drop-down box): Reference to a schedule that describes fraction of process electric use on an hourly basis.
- **RadFrac**: The fraction of radiant heat gain to a space based on appliance energy use.
- **LatFrac**: The fraction of latent heat gain to a space based on appliance energy use.
- **LostFrac**: The fraction of heat lost to the exterior is based on appliance energy use.
- **RefrigPwrDens**: The energy consumption of commercial refrigeration equipment in a space expressed in watts per square foot of space floor area. Commercial refrigeration EPD is used for walk in freezers, walk in coolers, and refrigerated casework. Other

equipment such as Plug in coolers, vending machines and plug in refrigerators should be accounted for in receptacle loads.

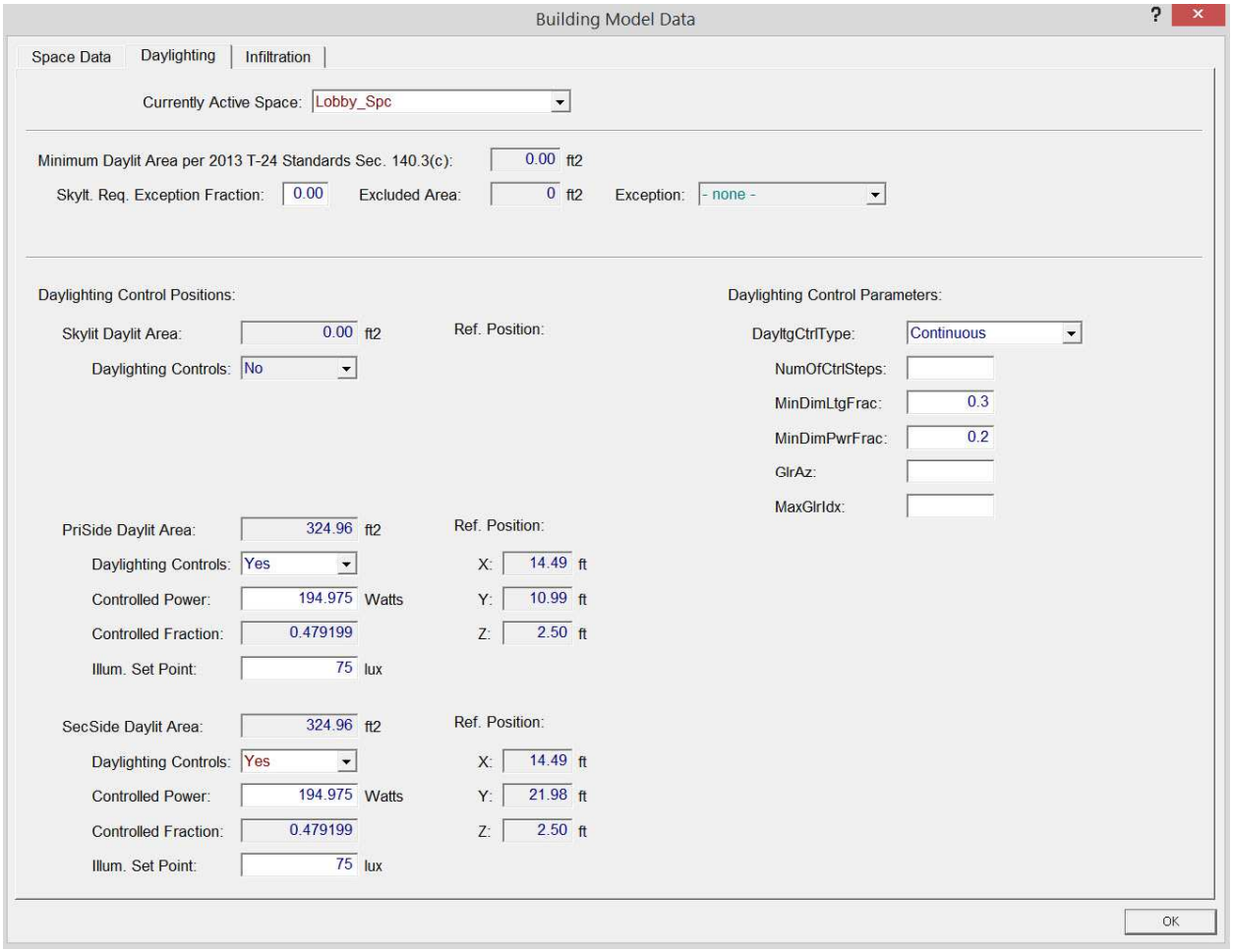
- **Schedules** (drop-down box): Reference to a schedule that describes fraction of refrigeration use on an hourly basis.
- **Elevator Count***: The number of individual elevators within the space.
- Schedules (drop-down box): The use of an elevator represented by a 24 hour schedule (fraction of density) associated with the occupancy type selected from the Area Category Method or Complete Building Method in ACM Appendix 5.4B
- **LostFrac:** The fraction of heat lost to the exterior based on appliance energy use. Fraction convective (sensible) is typically equal to 1.0 minus fraction radiant, minus fraction latent, minus fraction lost.
- **Escalator Count**:** The number of individual escalators or moving sidewalks within the space.
- **Schedules** (drop-down box): Reference to a schedule that describes the use of an escalator represented by a 24 hour schedule (fraction of density) associated with the occupancy type selected from the Area Category Method or Complete Building Method in ACM Appendix 5.4B.
- **LostFrac**: The fraction of heat lost to the exterior based on appliance energy use. Fraction convective (sensible) is typically equal to 1.0 minus fraction radiant, minus fraction latent, minus fraction lost.

Natural Gas Use section

- **GasEqpPwrDens**: Commercial gas power density is the average power density for all commercial gas equipment, assuming constant year-round operation.
- **Schedules** (drop-down box): Reference to a schedule that describes the fraction of gas equipment use on an hourly basis.
- **ProcGasPwrDens**: Process load is the gas energy consumption in the conditioned space of a building resulting from an activity or treatment not related to the space conditioning, lighting, service water heating, or ventilating of a building as it relates to human occupancy. Process load may include convective (sensible) and/or latent components.
- **RadFrac**: The fraction of radiant heat gain to a space based on appliance energy use.
- **LatFrac**: The fraction of latent heat gain to a space based on appliance energy use.
- **LostFrac**: The fraction of heat lost to the exterior based on appliance energy use.

Space Data Screen (Daylighting Tab)

To access this screen, double click on Space Data, and then click on the **Daylighting** tab.



Input summary for the Space Data screen (**Daylighting** tab):

- **Currently Active Space**: The name of the currently selected space.
- **Minimum Daylit Area per 2013 T-24 Standards Sec.140.3(c):** Area Required to be daylit (Skylit + Primary Sidelit) by Section 140.3c of Title 24 Standards.
- **Skylt. Req. Exception Fraction:** The fraction of floor area that is exempt from the Minimum Daylit Area requirement (2013 T-24 Standards Sec.140.3(c)).
- **Excluded Area:** Total area excepted from the skylight Minimum Daylit Area requirement.
- **Exception:** The specific exception to the Minimum Daylit Area requirement. Possible exceptions include:
    - The building is not located in climate zone 1 or climate zone 16 (automatically identified by CBECC software).
    - Designed general lighting is less than 0.5 W/ft2 (automatically identified by CBECC software).
    - Existing walls on plans result in enclosed spaces less than 5,000 ft2
    - Future walls or ceilings on plans result in enclosed spaces less than 5,000 ft2 or ceiling heights less than 15 feet.

  - Plans or documents show that space is an auditorium, religious building of worship, movie theater, museum, or refrigerated warehouse.
- **Skylit Daylit Area:** The skylit area is the portion of the floor area that gets daylighting from a skylight.
- **PriSide Daylit Area:** The primary sidelit daylit area is the portion of the floor area that gets the highest illumination from a window. Primary sidelit daylit area is defined as a band near the window with a depth equal to the distance from the floor to the top of the window and width equal to window width plus 0.5 times window head height wide on each side of the window opening.
- **SecSide Daylit Area:** The secondary sidelit daylit area is the portion of the floor area that gets less high, but still useful daylighting from a window. Secondary sidelit daylit area is defined as a band beyond the primary daylighted area that extends a distance double the distance from the floor to the top of the window and width equal to window width plus 0.5 times window head height wide on each side of the window opening.
- **Daylighting Control Positions:** Each daylit area type (Skylit, Primary Sidelit, and Secondary Sidelit) is automatically assigned a daylighting control position, which controls how the space lighting responds to the daylight illuminance measured at the control position. Each daylighting control position utilizes the following inputs:
- **Daylighting Controls:** Identifies the presence of active daylighting controls associated with the Daylighting Control Position.
- **Controlled Power:** The total lighting power (Watts) controlled by dayighting controls associated with the Daylighting Control Position.
- **Controlled Fraction:** The total fraction of the space lighting power controlled by daylighting controls associated with the Daylighting Control Position.
- **Illum. Set Point:** The design illuminance for the daylit area associated with the Daylighting Control Position. Lighting controls are simulated so that the illuminance at the reference position is always maintained at or above the illuminance setpoint.
- **Ref. Position:** The position of the daylight reference points within the daylit space, identified by the Cartesian **X**, **Y**, and **Z** position of the reference point (feet), with respect to the overall project coordinate system.

Daylighting Control Parameters: The following inputs describe the daylighting control algorithm for all of the controls located within a particular space.

- **DayltgCtrlType:** The type of control that is used to control the electric lighting in response to daylight available at the reference point. The options are:
  - Stepped Switching Controls vary the electric input power and lighting output power in discrete equally spaced steps. See At each step, the fraction of light output is equal to the fraction of rated power. .
  - Continuous Dimming controls have a fraction to rated power to fraction of rated output that is a linear interpolation of the minimum power fraction at the minimum diming light fraction to rated power (power fraction = 1.0) at full light output
  - Continuous Dimming + Off controls are the same as continuous dimming controls except that these controls can turn all the way off when none of the controlled light output is needed.
- **NumOfControlSteps**: Number of control steps. For step dimming, identifies number of steps that require fraction of rated light output and rated power fraction**.**
- **MinDimLtgFrac:** Minimum light output of controlled lighting when fully dimmed. Minimum light fraction = (Minimum light output) / (Rated light output).

- **MinDimPwrFrac:** The minimum power fraction when controlled lighting is fully dimmed. Minimum power fraction = (Minimum power) / (Full rated power).
- **GlrAz:** This field specifies the view direction for calculating glare. It is the angle, measured clockwise in the horizontal plane, between the zone y-axis and the occupant view direction.
- **MaxGlrIdx:** If a daylit zone has windows with shading devices (except exterior screens), the shades will be deployed if the daylight glare at the First Reference Point exceeds the value of this field.

Space Data Screen (Infiltration Tab)

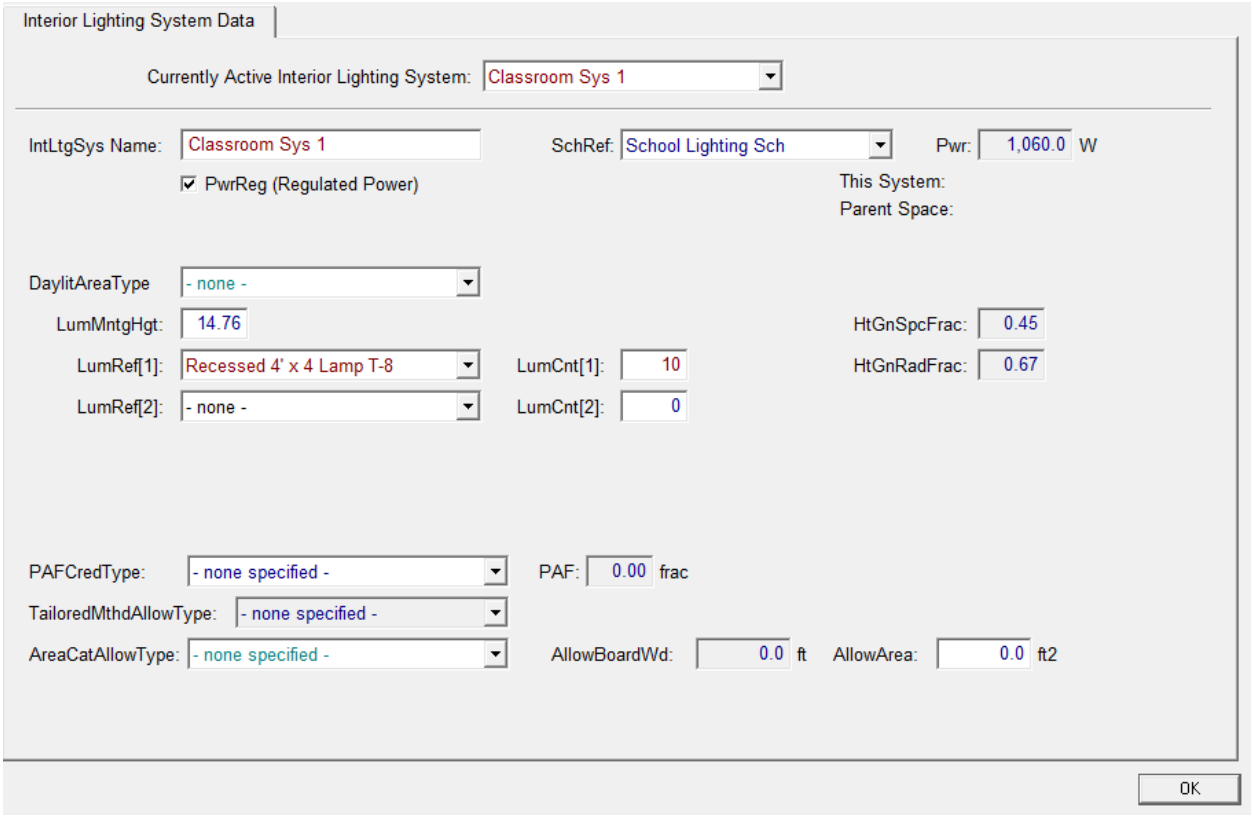
To access this screen, double click on Space Data, and then click on the **Infiltration** tab.

Input summary for the **Infiltration** tab:

- **InfMthd**: The method used to calculate infiltration rate, specified by the ACM to be leakage through the building walls per unit area (cfm/ft²).
  Methods available to calculate infiltration include effective leakage area, which is generally applicable for small residential scale buildings. The required component leakage method requires the user to specify the average leakage through the building wall per unit area (cfm/ft²). Component leakage rates can also be applied to the total building envelope area. Specification of a maximum rate, usually as air changes per hour, is also used. For all methods, the rate is modified by a schedule.
- **Infiltration Model Coefficients**: The constant and linear coefficients to affect the infiltration.
- **DesgnInfRt**: Design infiltration airflow.

Interior Lighting System Data Screen

To access this screen, right click on a space and scroll down to **Create** in the drop-down box. Then click **InteriorLightingSystem.** The **Create InteriorLightingSystem** dialog box appears. Make your selections and click **OK.**



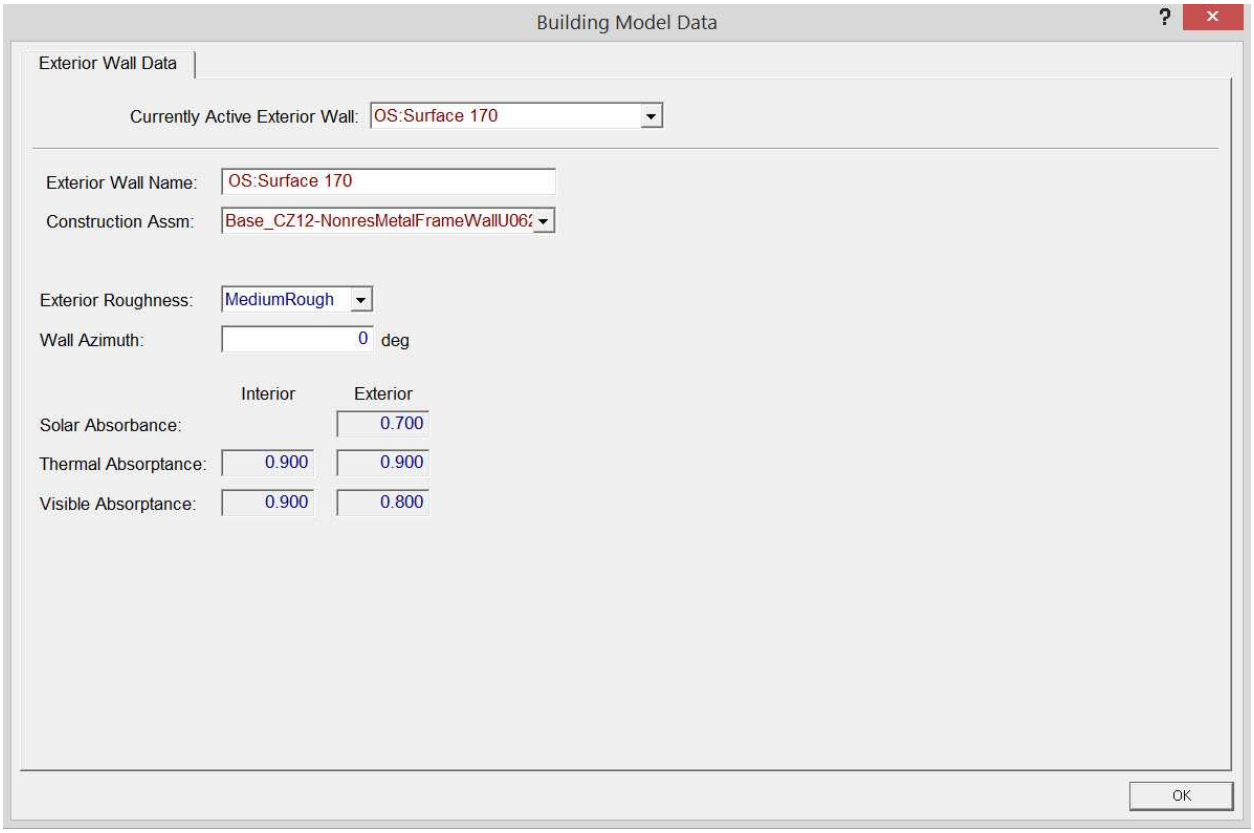
Input summary for Interior Lighting System Data:

- **Currently Active Interior Lighting System**: The name of the currently selected interior lighting system.
- **IntLtgSys Name**: The name of the Interior Lighting System.
- **PwrReg** (Regulated Power): Whether this lighting system's power is Regulated vs. Non-Regulated. Defaults to True (regulated).
- **SchRef:** Reference to a unique Schedule Name of interior type for association with an interior lighting system.
- **Pwr**: Luminaire power (taking Count into account).
- **DaylitAreaType**: The origin of the daylight.
- **LumMntgHgt**: The Luminaire Height of an IntLtgSys, only necessary for Tailored Method Baseline General and Additional Lighting Power Allowances. Assumed by default to be the same as the space floor to ceiling height.
- **LumRef[1]:** Whether or not first luminaire is assigned.
- **LumRef[2]:** Whether or not second luminaire is assigned.
- **LumCnt[1]:** Luminaire count.
- **LumCnt[2]:** Luminaire count.
- **HtGnSpcFrac:** Fraction of interior lighting heat gain going to space air.
- **HtGnRadFrac**: Fraction of interior lighting radiant heat gain going to space surfaces.

- **PAFCredType**: Selection of PAF Credit Type allows the software to apply the power adjustment factors (PAF) which represents the percent reduction in lighting power that will approximate the effect of the control. Models account for such controls by multiplying the controlled watts by (1-PAF).
- **PAF**: Power adjustment factors (PAFs) represent the percent reduction in lighting power that will approximate the effect of the control. Models account for such controls by multiplying the controlled watts by (1-PAF).
- **TailoredMthdAllowType**: Custom Lighting Power Allowance Type for Interior Lighting Specified via Tailored Method.
- **AreaCatAllowType**: Custom Lighting Power Allowance Type for Interior Lighting Specified via Area Category Method.
- **AllowBoardWd**: The Width (ft) of Chalk/Display Board to which the Area Category or Tailored Allowance (W/ft) is applied.
- **AllowArea**: The Area (ft2) of to which the Area Category or Tailored Allowance (W/ft2) is applied.

Exterior Wall Data Screen

To access this screen, under Space Data double click Surface Data (Exterior Wall).



Input summary for the Exterior Wall Data screen:

- **Currently Active Exterior Wall:** The name of the currently selected exterior wall.
- **Exterior Wall Name**: The name or description used to identify the exterior wall.
- **Construction Assm:** Construction assembly reference (construction name) for an exterior wall (input is optional). A reference to a construction assembly.
- **Exterior Roughness:** The surface texture affecting convection.
- **Wall Azimuth:** A measure of the orientation of a planar surface. The azimuth of any planar building surface element is measured in the plane upon which the building sits (the base plane). It is the angle, measured clockwise, between the true North vector and the outward pointing normal to the building surface element. The azimuth of a North-facing building surface is thus 0 degrees. Units: degrees. Cardinal orientation of north, south, east and west can be derived from the Azimuth.
- **Solar Absorbance:** The fraction of the solar energy absorbed by the wall.
- **Thermal Absorptance:** The fraction of infrared energy absorbed by the wall.
- **Visible Absorptance:** The fraction of visible light absorbed by the wall.

Subsurface Data (Window) Screen

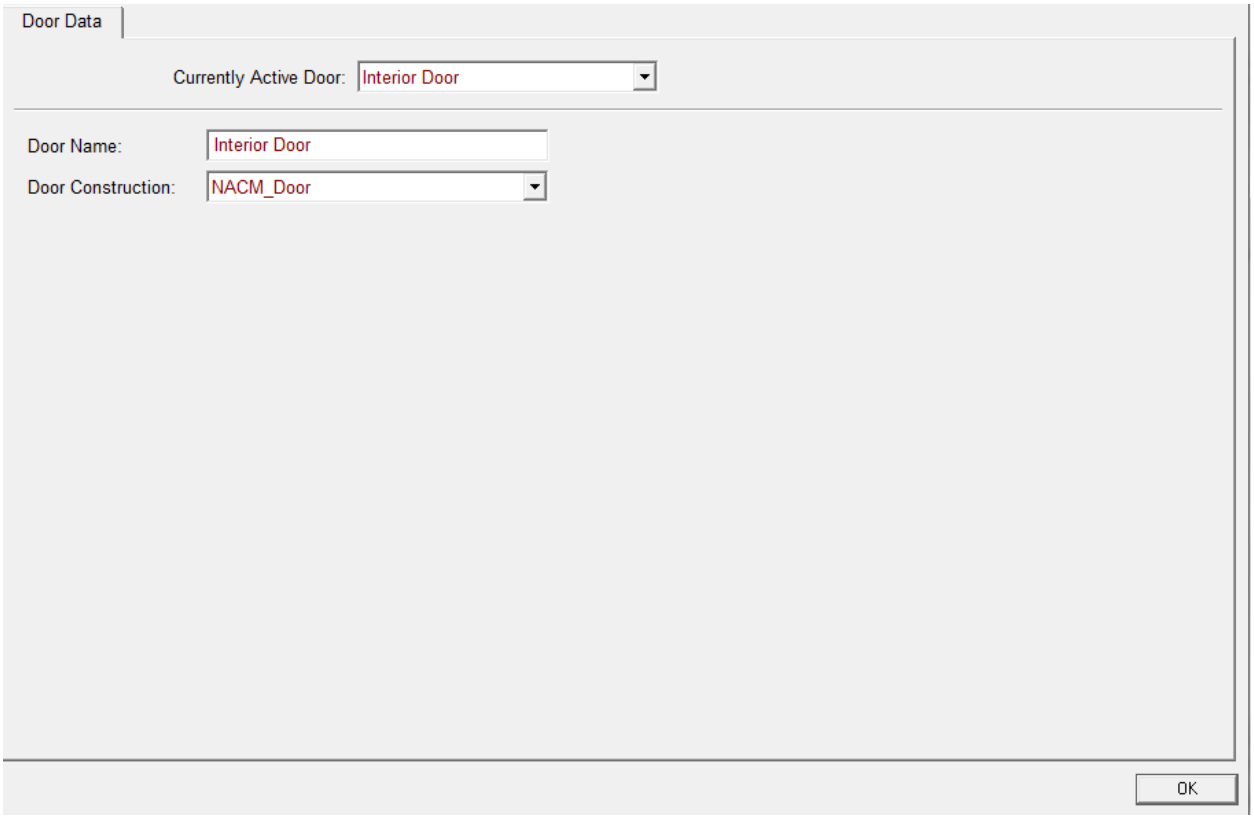
To access this screen, under SubSurface Data (Window) double click Subsurface Data.

Input summary for the SubSurface Window Data:

- **Currently Active Window:** The name of the currently selected window.
- **Window Name**: The name or description used to identify the window.
- **Fen Construction**: Fenestration Construction reference for a window.
- **Window Area:** Calculate Area of each window.

Sub Surface (Door) Data Screen

To access this screen, right click **Surface** (Exterior Wall) and scroll down to Create in the drop-down box. Then click **Door.**



Input summary for SubSurface Data (Door Data):

- **Currently Active Door**: The name of the currently selected door.
- **Door Name**: The name or description used to identify the door.
- **Door Construction**: Door construction (Input is optional).

Poly Loop Data Screen

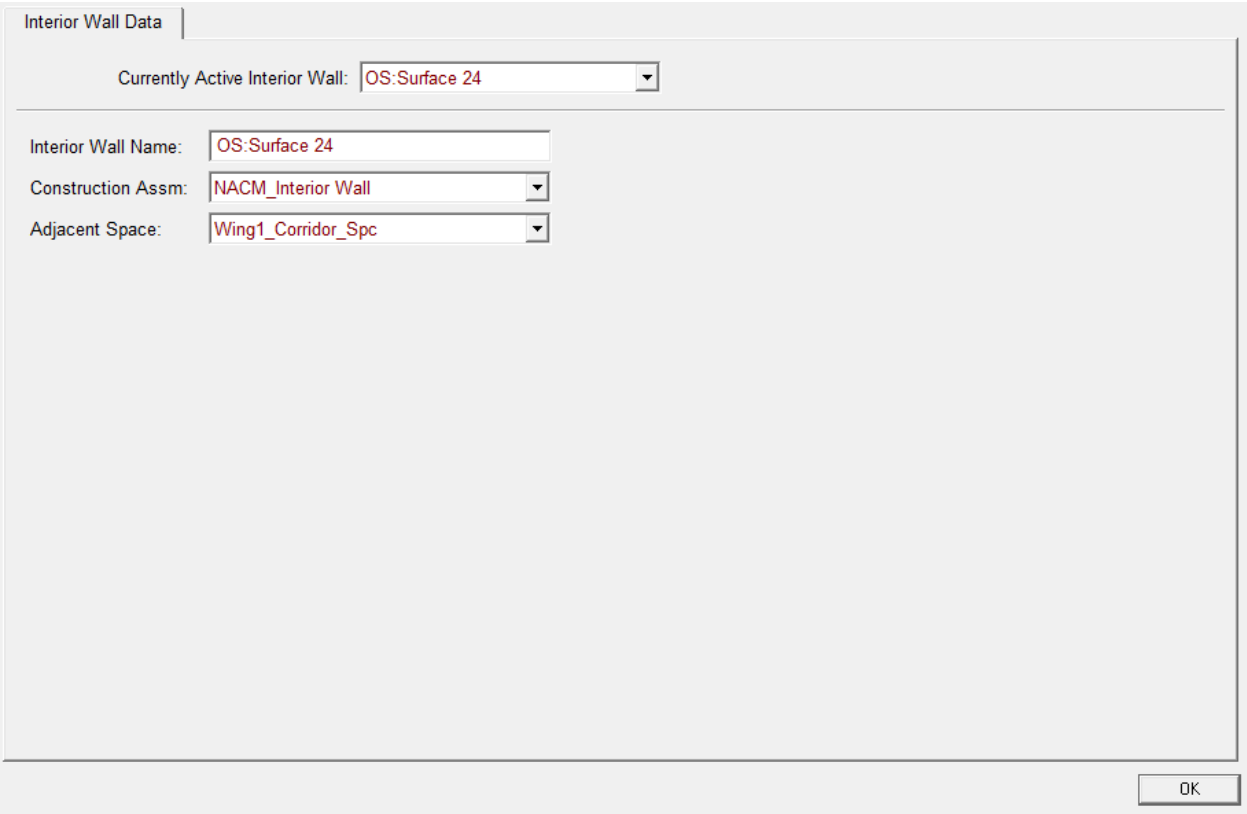
To access this screen, under Surface Data (Exterior Wall) double click **Poly Loop Data**.

Input summary for the Poly Loop Data screen:

- **Poly Loop Name:** The name or description used to identify the Poly Loop.
- **Area (temporary):** Area of Poly Loop.

Surface Data (Interior Wall) Screen

To access this screen, under Space Data double click on Surface Data (Interior Wall).

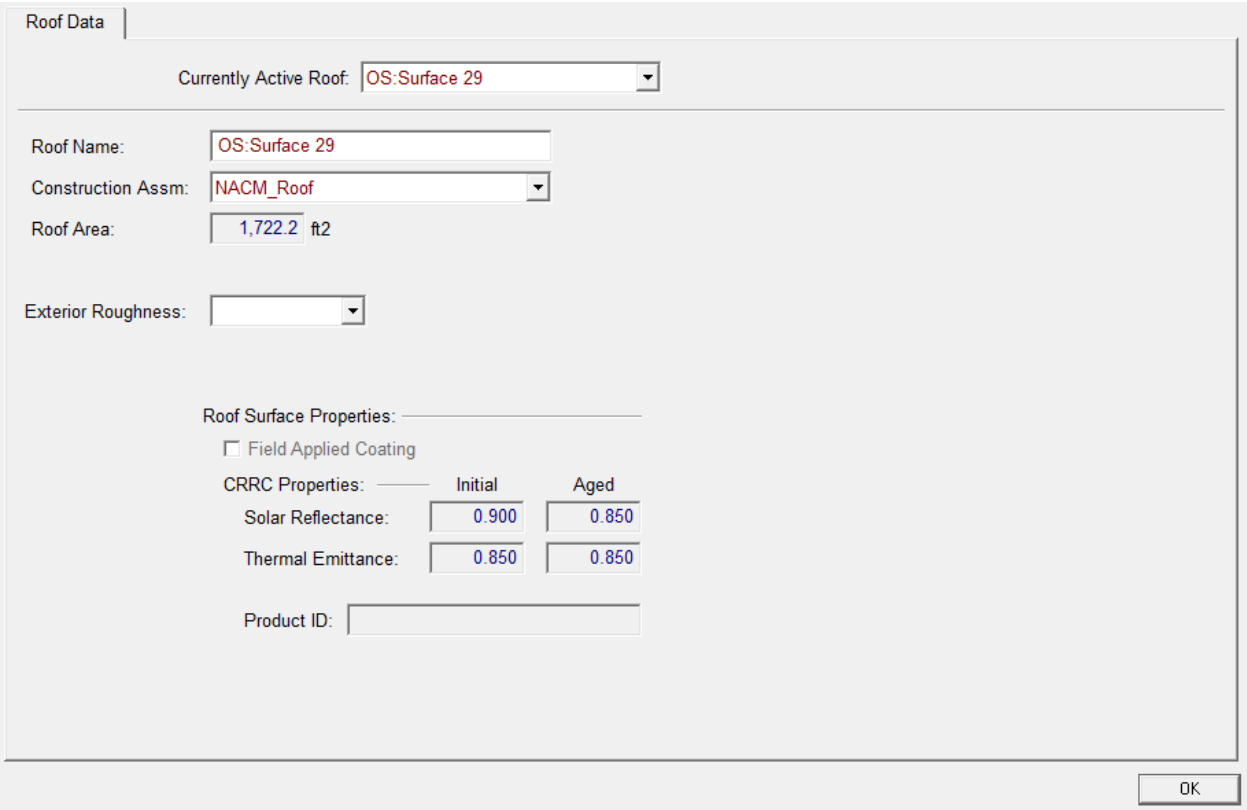


Input summary for Surface Data (Interior Wall):

- **Currently Active Interior Wall**: The name of the currently selected interior wall.
- **Interior Wall Name**: The name or description used to identify the interior wall.
- **Construction Assm**: Construction assembly reference (construction name) for a demising wall (input is optional).
  A reference to a construction assembly.
- **Adjacent Space**: This references the space on the other side of an interior partition.

Roof Data (Surface Data) Screen

To access this screen, under Space Data double click Surface Data (Roof).



Input summary for Surface Data (Roof):

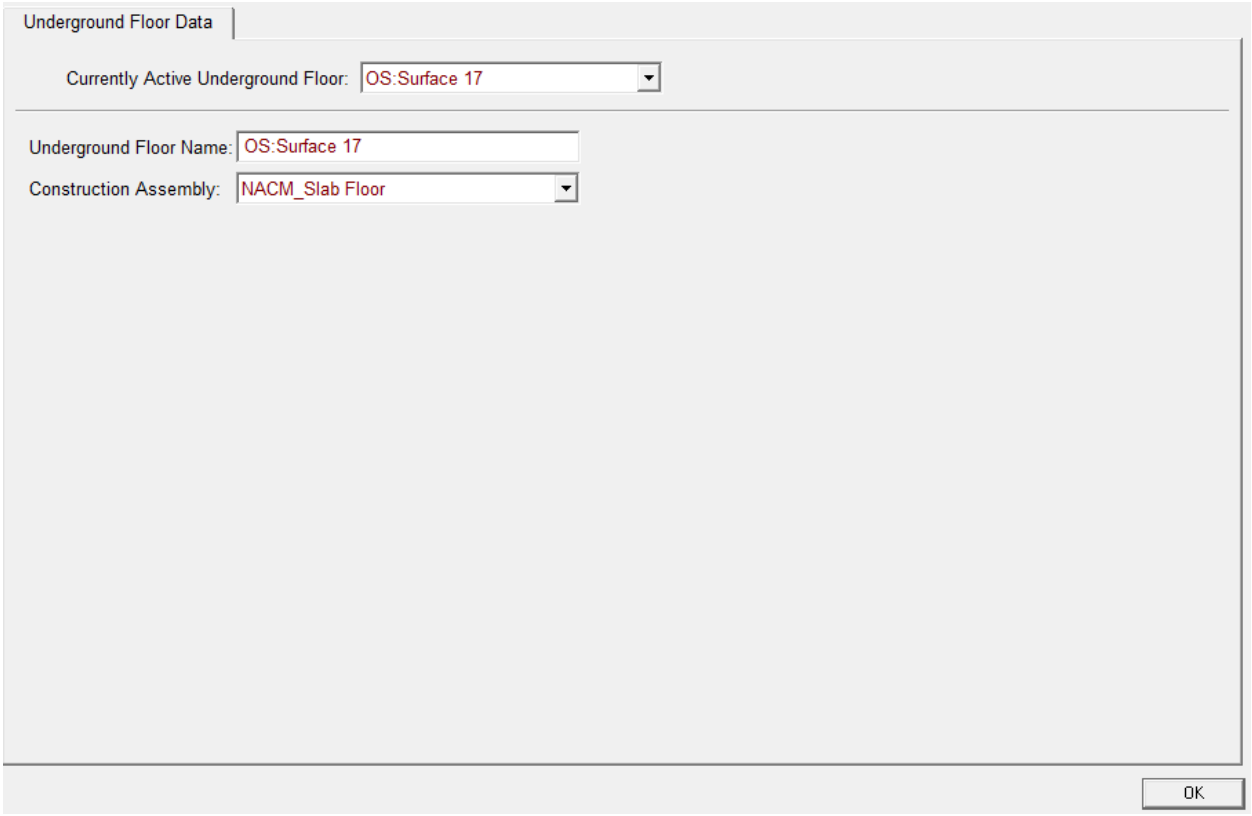
- **Currently Active Roof**: The name of the currently selected roof.
- **Roof Name**: A unique name that identifies the roof.
  A unique name or code that identifies the roof and ties it to the construction documents submitted for energy code review. It is not mandatory to name roofs.
- **Construction Assm**: Construction assembly reference for a roof (input is optional).
- **Roof Area**: Calculate area of each roof (not editable).
- **Exterior Roughness**: The surface texture affecting convection.

Roof Surface Properties section

- **Field Applied Coating** (checkbox): Option used if a coating was applied in the field.
- **Solar Reflectance**: The fraction of solar energy reflected by the coating.
- **Thermal Emittance:** The fraction infrared energy emitted by the coating.
- **Product ID**: The unique identifier of the coating.

Underground Floor Data (Surface Data) Screen

To access this screen, under Space Data double click **Surface Data (Floor).**

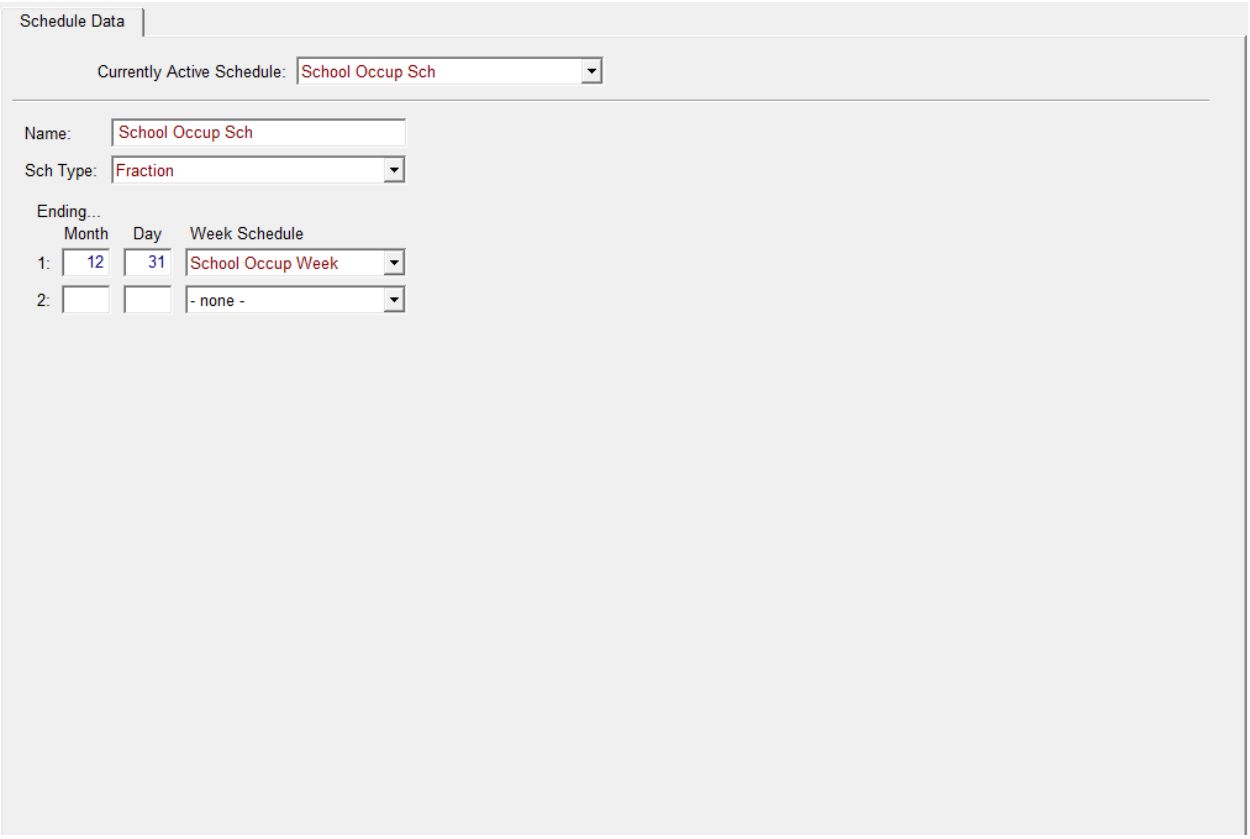


Input summary for Underground Floor (Surface Data):

- **Currently Active Underground Floor**: The name of the currently selected underground floor.
- **Underground Floor Name**: The name or description used to identify the underground floor.
- **Construction Assembly**: Construction assembly reference (construction name) for an Underground Floor (input is optional).
  A reference to a construction assembly.

Schedules Data Screen

To access this screen, under Project name expand **Schedules** and double click an option.

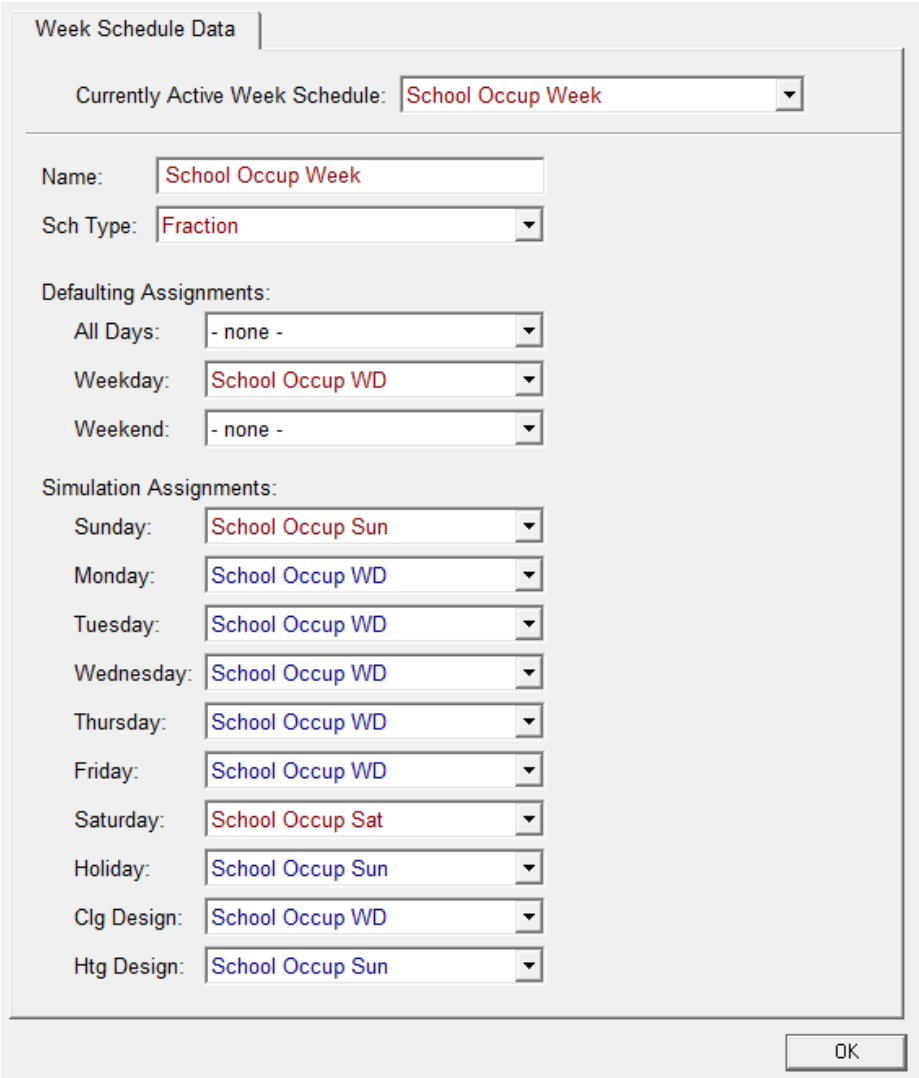


Input summary for Schedules Data:

- **Currently Active Schedule**: The name of the currently active schedule.
- **Name**: The name of the schedule.
- **Sch Type**: A list of schedule control mechanisms comprising of Fraction, OnOff, and Temperature.
- **Ending…Month**: Index of ending month (1-12) for the first referenced week schedule.
- **Ending…Day**: Index of ending day (1-31) for the first referenced week schedule.
- **Ending…Week Schedule:** The week schedule used in the time period.

Schedules Weeks Data (Weekly) Screen

To access this screen, under Project name expand **ScheduleWeeks** and double click an option.



Input summary for ScheduleWeeks Data:

- **Currently Active Week Schedule**: The name of the currently selected week schedule.
- **Name:** The name of the schedule.
- **Sch Type:** A list of schedule control mechanisms comprising of Fraction, OnOff, and Temperature.

Defaulting Assignments section

- **All Days:** Reference to the All Days schedule.
- **Weekday:** Reference to the Weekday schedule.
- **Weekend:** Reference to the Weekend schedule.

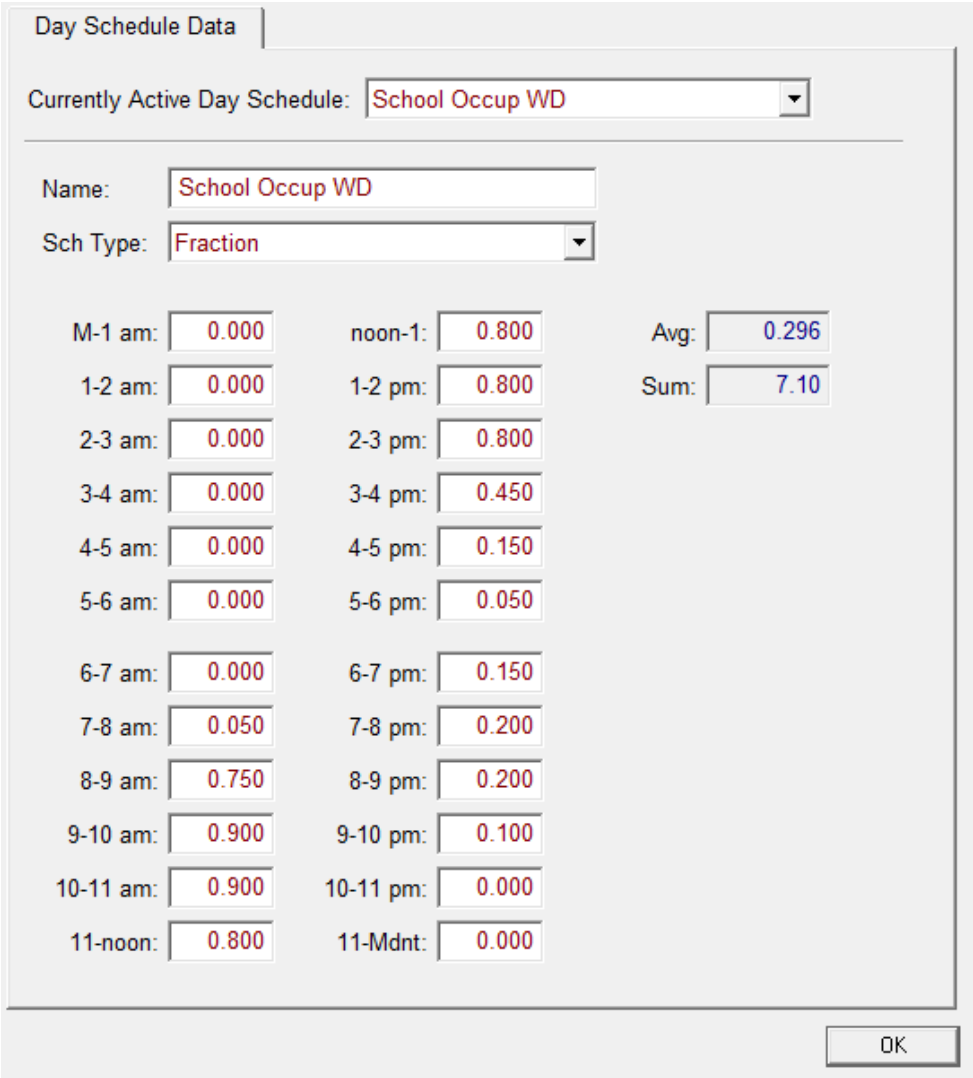
Simulation Assignments section

- **Sunday**: Reference to the Sunday schedule.

- **Monday**: Reference to the Monday schedule.
- **Tuesday**: Reference to the Tuesday schedule.
- **Wednesday**: Reference to the Wednesday schedule.
- **Thursday**: Reference to the Thursday schedule.
- **Friday**: Reference to the Friday schedule.
- **Saturday:** Reference to the Saturday schedule.
- **Holiday**: Reference to the Holiday schedule.
- **Clg Design:** Reference to the Cooling Design (sizing) day schedule.
- **Htg Design**: Reference to the Heating Design (sizing) day schedule.

Schedules Days Data (Daily) Screen

To access this screen, under Project name expand **ScheduleDays** and double click an option.



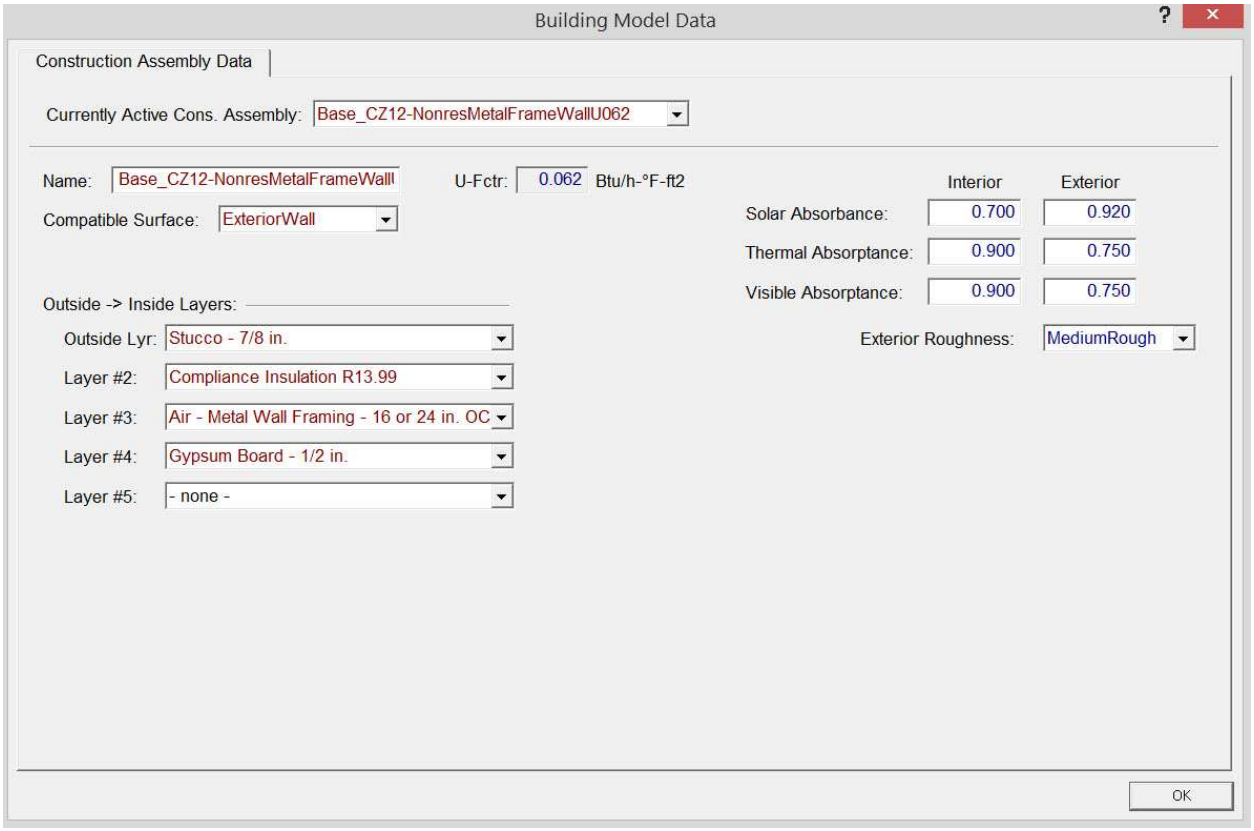
Input Summary screen for **ScheduleDays** Data:

- **Currently Active Day Schedule**: The name of the currently selected day schedule.
- **Name:** The name or description used to identify the day schedule.
- **Sch Type**: A list of schedule control mechanisms comprising of Fraction, OnOff, and Temperature.
- **M-1 am**: One hour occurrence between midnight and 1 a.m.
- **1-2 am**: One hour occurrence between 1 a.m. and 2 a.m.
- **2-3 am:** One hour occurrence between 2 a.m. and 3 a.m.
- **3-4 am**: One hour occurrence between 3 a.m. and 4 a.m.
- **4-5 am**: One hour occurrence between 4 a.m. and 5 a.m.
- **5-6 am**: One hour occurrence between 5 a.m. and 6 a.m.
- **6-7 am**: One hour occurrence between 6 a.m. and 7 a.m.
- **7-8 am**: One hour occurrence between 7 a.m. and 8 a.m.

- **8-9 am**: One hour occurrence between 8 a.m. and 9 a.m.
- **9-10 am**: One hour occurrence between 9 a.m. and 10 a.m.
- **10-11 am**: One hour occurrence between 10 a.m. and 11 a.m.
- **11-noon**: One hour occurrence between 11 a.m. and noon.
- **noon-1**: One hour occurrence between noon and 1 p.m.
- **1-2 pm**: One hour occurrence between 1 p.m. and 2 p.m.
- **2-3 pm**: One hour occurrence between 2 p.m. and 3 p.m.
- **3-4 pm**: One hour occurrence between 3 p.m. and 4 p.m.
- **4-5 pm**: One hour occurrence between 4 p.m. and 5 p.m.
- **5-6 pm**: One hour occurrence between 5 p.m. and 6 p.m.
- **6-7 pm**: One hour occurrence between 6 p.m. and 7 p.m.
- **7-8 pm**: One hour occurrence between 7 p.m. and 8 p.m.
- **8-9 pm:** One hour occurrence between 8 p.m. and 9 p.m.
- **9-10 pm**: One hour occurrence between 9 p.m. and 10 p.m.
- **10-11 pm**: One hour occurrence between 10 p.m. and 11 p.m.
- **11-Mdnt**: One hour occurrence between 11 p.m. and midnight.

Construction Assembly Data Screen

To access this screen, under Project name expand **ConstructAssemblies** and double click **(Exterior Wall)**.


Building Model Data
Construction Assembly Data
Currently Active Cons. Assembly: Base_CZ12-NonresMetalFrameWallU062
Name: Base_CZ12-NonresMetalFrameWall
U-Fctr: 0.062 Btu/h-°F-ft2
Compatible Surface: ExteriorWall
Interior
Exterior
Solar Absorbance: 0.700 0.920
Thermal Absorptance: 0.900 0.750
Visible Absorptance: 0.900 0.750
Outside -> Inside Layers:
Outside Lyr: Stucco - 7/8 in.
Layer #2: Compliance Insulation R13.99
Layer #3: Air - Metal Wall Framing - 16 or 24 in. OC
Layer #4: Gypsum Board - 1/2 in.
Layer #5: - none -
Exterior Roughness: MediumRough
OK

Input summary for Construction Assembly Data:

- **Currently Active Cons. Assembly:** The name of the currently selected construction assembly.
- **Name:** The name or description used to identify the construction assembly.
- **U:Fctr: The overall U Factor of the selected Construction Assembly.**
- **Compatible Surface:** The type of surface object that this construction assembly can be assigned to.
- **Solar Absorbance (Interior):** Represents the fraction of incident solar radiation that is absorbed by the inward facing surface of the overall ConstructionAssembly, with respect to the Space that the surface is assigned to.
- **Solar Absorbance (Exterior):** Represents the fraction of incident solar radiation that is absorbed by the outward facing surface of the overall ConstructionAssembly, with respect to the Space that the surface is assigned to.
- **Thermal Absorptance (Interior):** Represents the fraction of incident long wavelength radiation that is absorbed by the inward facing surface of the overall ConstructionAssembly, with respect to the Space that the surface is assigned to.
- **Thermal Absorptance (Exterior):** Represents the fraction of incident long wavelength radiation that is absorbed by the outward facing surface of the overall ConstructionAssembly, with respect to the Space that the surface is assigned to.

- **Visible Absorptance (Interior):** Represents the fraction of incident visible wavelength radiation that is absorbed by the inward facing surface of the overall ConstructionAssembly, with respect to the Space that the surface is assigned to.
- **Visible Absorptance (Exterior):** Represents the fraction of incident visible wavelength radiation that is absorbed by the outward facing surface of the overall ConstructionAssembly, with respect to the Space that the surface is assigned to.
- **Exterior Roughness:** The relative roughness of the exterior surface. The roughness affects convective heat transfer of the surface.

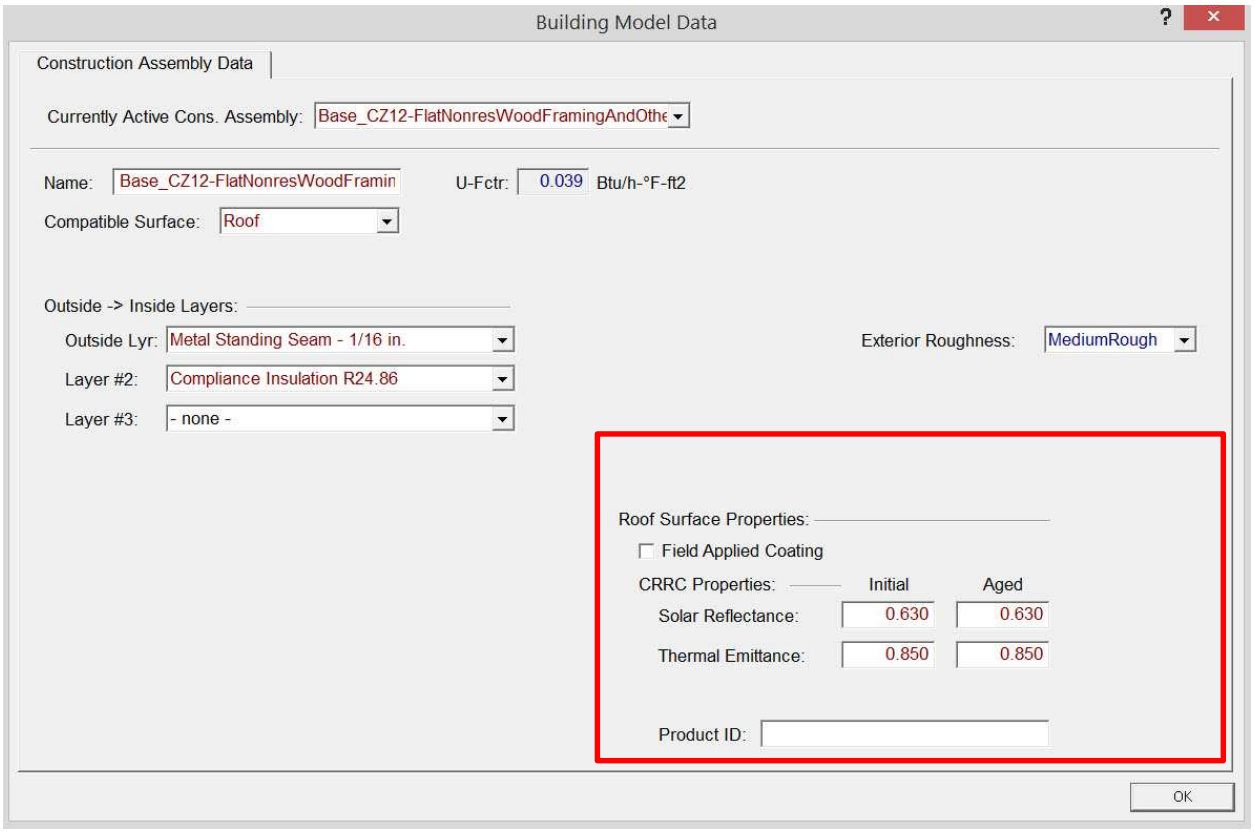
Outside -> Inside Layers section

- **Outside Lyr:** The material specified in the outside layer.
- **Layer #2:** The material specified in the second layer.
- **Layer #3:** The material specified in the third layer.
- **Layer #4:** The material specified in the fourth layer.
- **Layer #5:** The material specified in the fifth layer.
- **Layer #6:** The material specified in the sixth layer.

Construction Assembly Data Screen (Compatible Surface = Roof)

To access this screen, under Project name expand **ConstructAssemblies** and double click **(Roof)** option.

Note: Selecting *Compatible Surface = Roof* prompts you to add additional inputs (red box below).



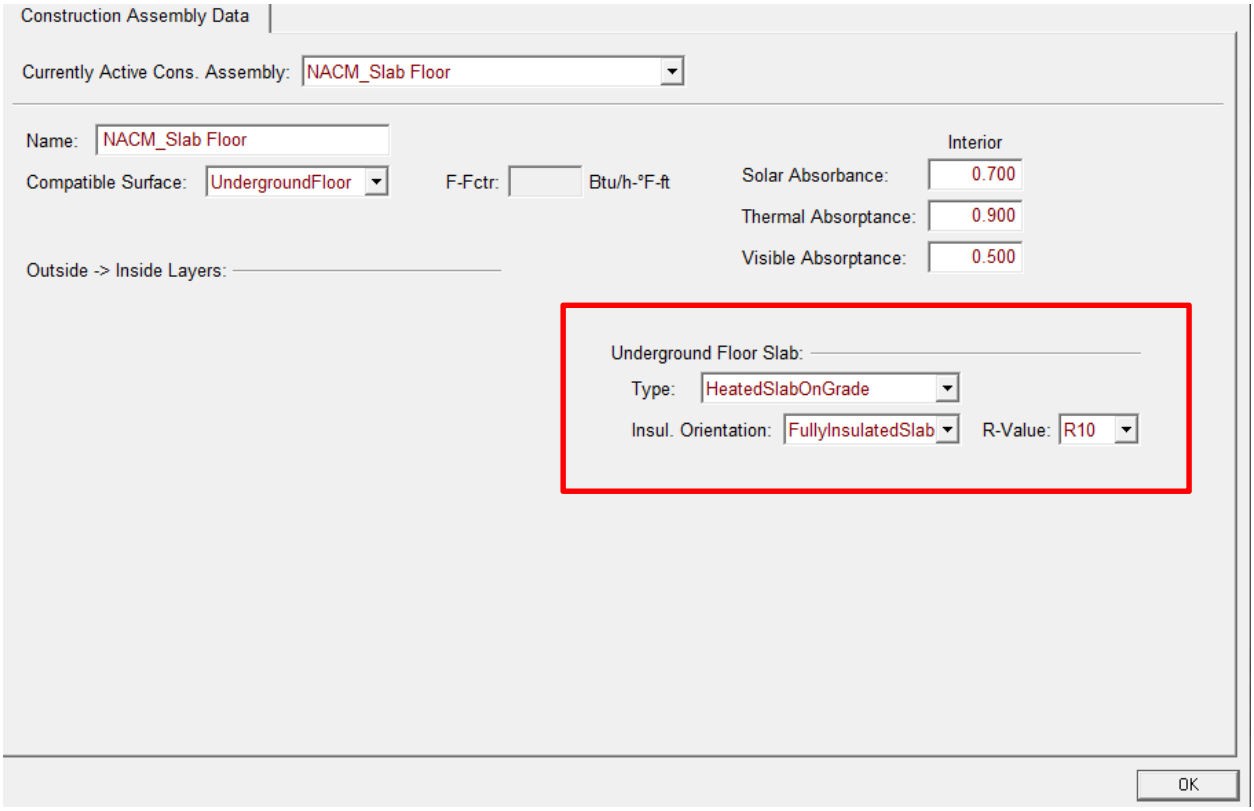
Input summary for **Roof Surface Properties**:

- **Field Applied Coating** (checkbox): A flag to indicate if the roofing surface is from a coating applied on site or not.
- **Solar Reflectance** (Initial): The Initial Reflectance value from Cool Roof Rating Council (CRRC) testing of the roofing.
- **Solar Reflectance** (Aged): The Aged Reflectance value from Cool Roof Rating Council testing of the roofing.
- **Thermal Emittance** (Initial): The Initial Emittance value from Cool Roof Rating Council testing of the roofing.
- **Thermal Emittance** (Aged): The Aged Emittance value from Cool Roof Rating Council testing of the roofing.
- **Product ID**: The unique identifier of the coating.

Construction Assembly Data Screen: (Compatible Surface = UndergroundFloor)

To access this screen, under Project name expand **ConstructAssemblies** and double click **(Underground Floor)** option.

Note: Selecting *Compatible Surface = UndergroundFloor* prompts you to add additional inputs (red box below).

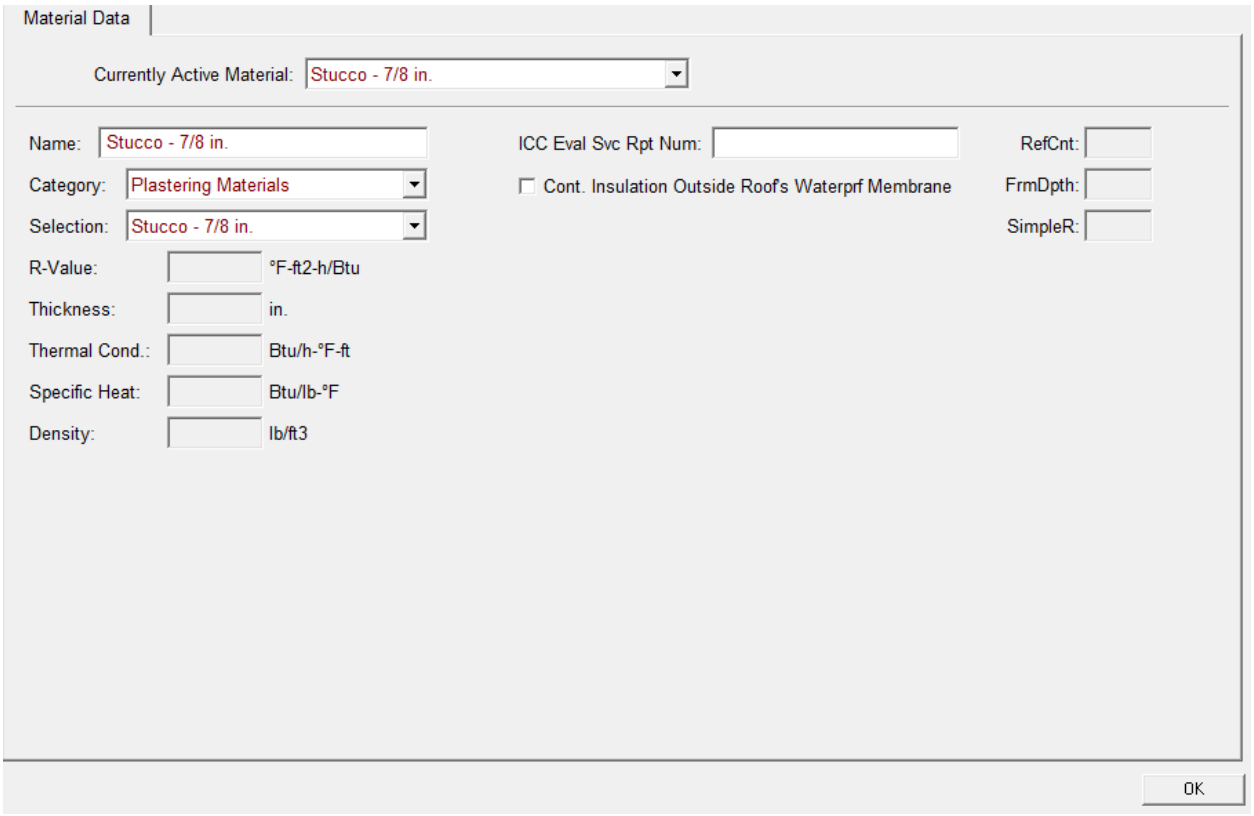


Input summary for **Underground Floor Slab**:

- **Type:** The Underground slab type. Available options are HeatedSlabOnGrade, HeatedSlabBelowGrade, UnheatedSlabOnGrade, and UnheatedSlabBelowGrade.
- **Insul. Orientation**: The location and extent of slab-on-grade floor insulation.
- **R-Value**: Nominal R-value of the underground floor slab.

Material Data (Single Layer) Screen

To access this screen, under Project name expand **Materials** and double click the **Stucco** option.



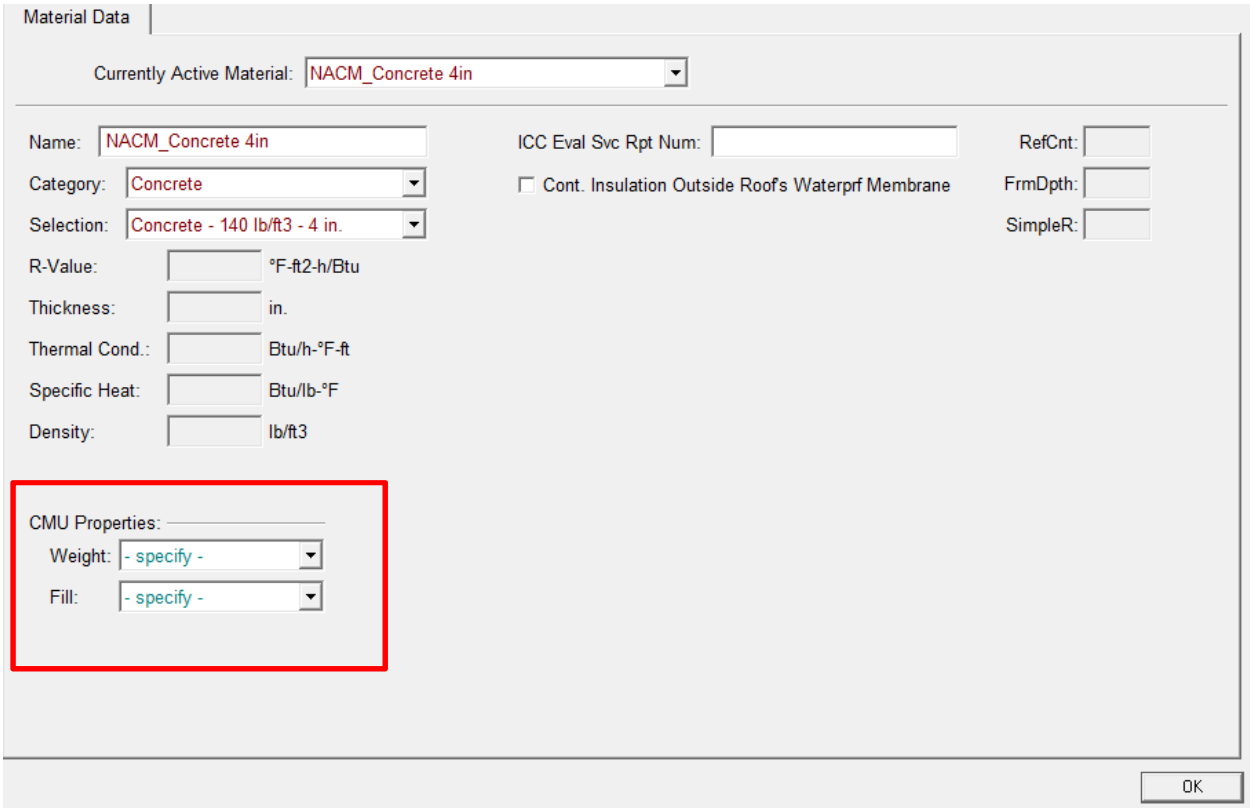
Input summary for **Material Data** screen (single layer):

- **Currently Active Material**: The name of the currently selected active material.
- **Name:** The name or description used to identify the active material.
- **Category:** The name or code for a type of material used as a layer in construction assemblies.
- **Selection:** The material selected from the available options.
- **ICC Eval Svc Rpt Num:** The ICC Evaluation Service Report number for a spray foam or other non-standard insulating product.
- **Cont. Insulation Outside Roof's Waterprf Membrane** (checkbox): Select if insulation is installed on the outside of the membrane completely.
- **RefCnt:** Number of times this Material is referenced by ConsAssm objects.
- **FrmDpth:** Depth (in inches) of composite layer cavity.
- **SimpleR:** R Value of the composite Layer.

Materials Data (Single Layer) Screen (Category = Concrete)

To access this screen, under Project name expand **Materials** and double click the **Concrete** option.

Note: Selecting *Category = Concrete* prompts you to add additional inputs (red box below).



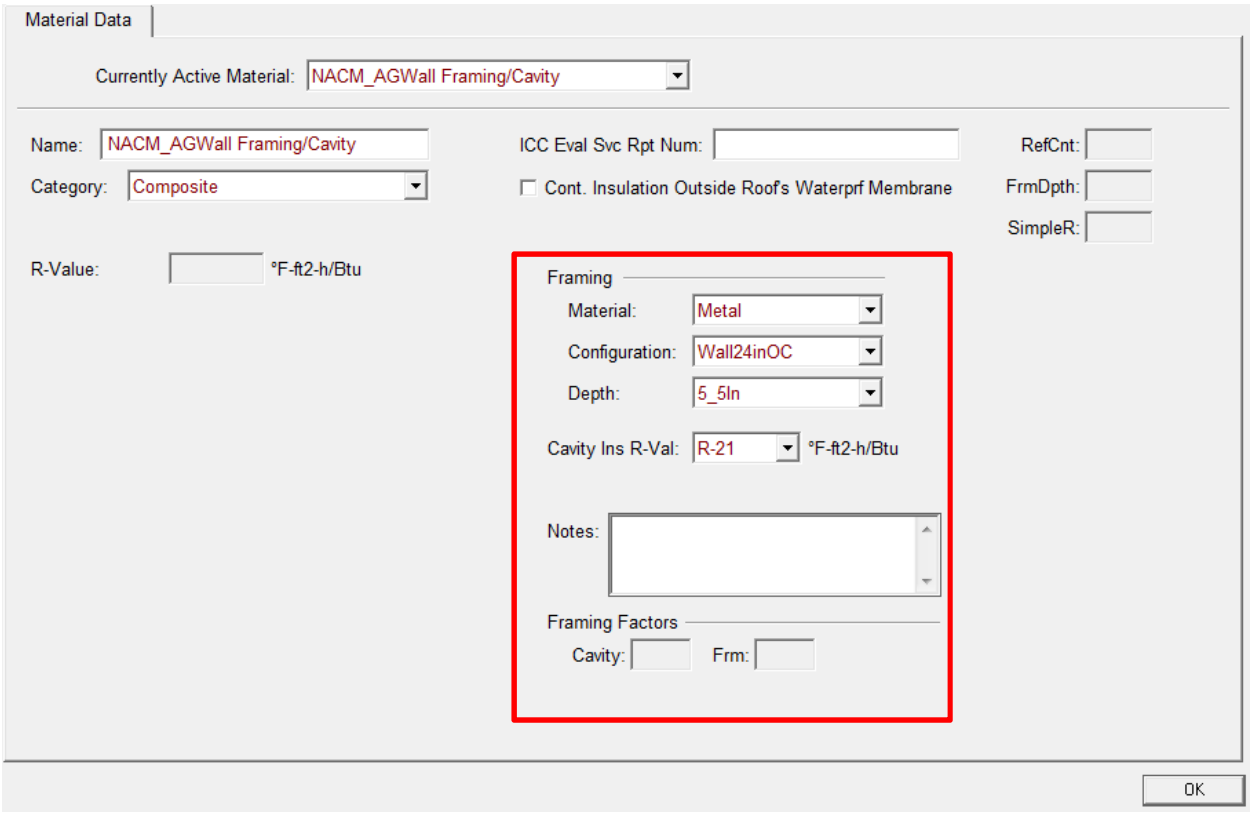
Input summary for **Materials** Data (Category = Concrete):

- **Weight**: The relative density of a CodeCategory = CMU material layer. The definitions correspond to the following density values:
  - 105 lb/ft^3 for lightweight
  - 115 lb/ft^3 for medium weight
  - 125 lb/ft^3 for normal weight
  - 130 lb/ft^3 for clay unit.
- **Fill:** The fill condition of hollow unit masonry walls. The definitions correspond to the following conditions:
  - Solid: Where every cell is grouted.
  - Empty: Where the cells are partially grouted and the remaining cells are left empty.
  - Insulated: Where the cells are partially grouted and the remaining cells are filled with perlite or some other insulating material.

Materials Data (Composite) Screen

To access this screen, under Project name expand **Materials** and double click the Air – Metal Wall Framing option. Then in **Category** select **Composite.**

Note: Selecting *Category = Composite* in the Material Data screen prompts you to add additional inputs (red box below) describing the framing configuration and cavity insulation.



Input summary for Materials Data Composite screen (**Framing** section):

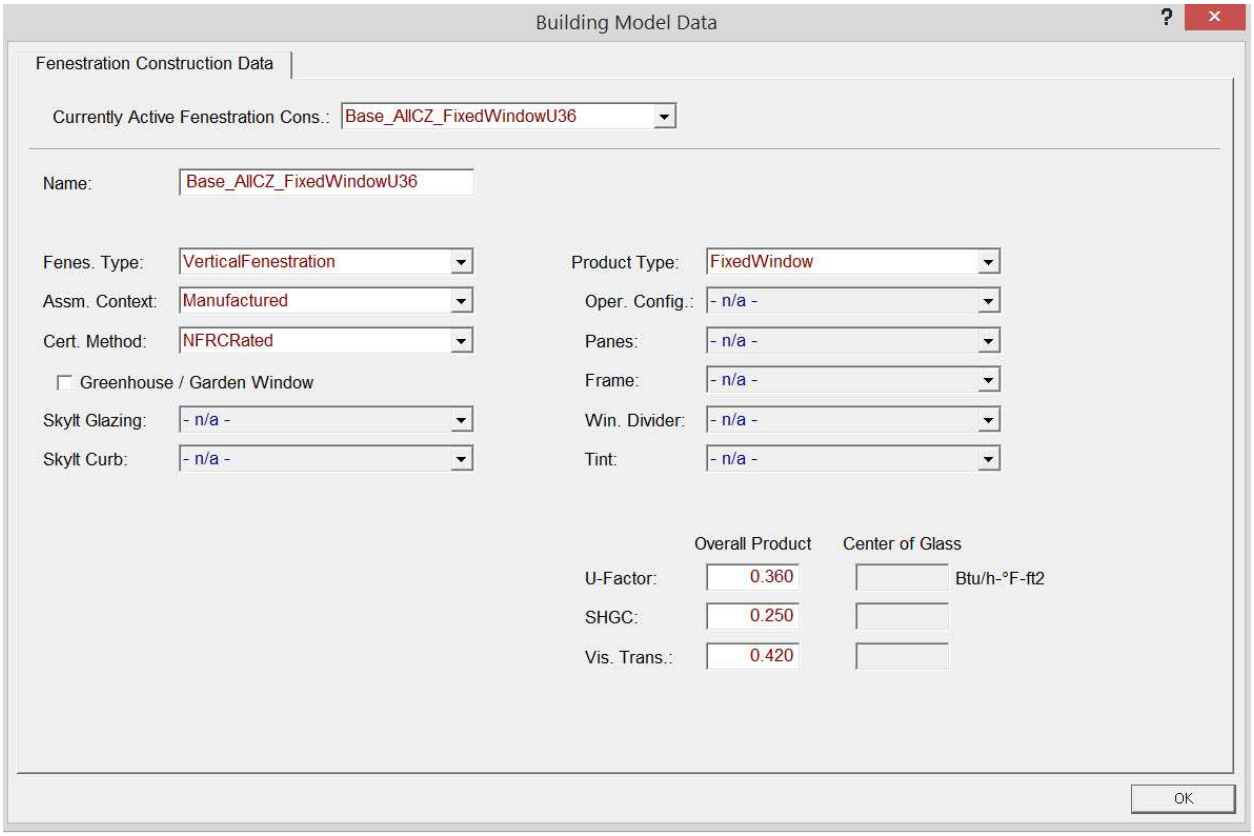
- **Material:** The framing is constructed with the selected material.
- **Configuration:** The framing is constructed with the selected configuration.
- **Depth**: The framing is constructed with the selected depth.
- **Cavity Ins R-Val:** Nominal R-value of composite layer cavity insulation.
- **Notes**: A space to leave detailed information about the framing material and construction.

Framing Factors Section

- **Cavity**: Fraction of cavity in the composite layer.
- **Frm**: Framing factor (fraction) of framing members.

Fenestration Construction Data Screen

To access this screen, under Project name expand **FenestrationConstructions** and double click the **FixedWindow** option.



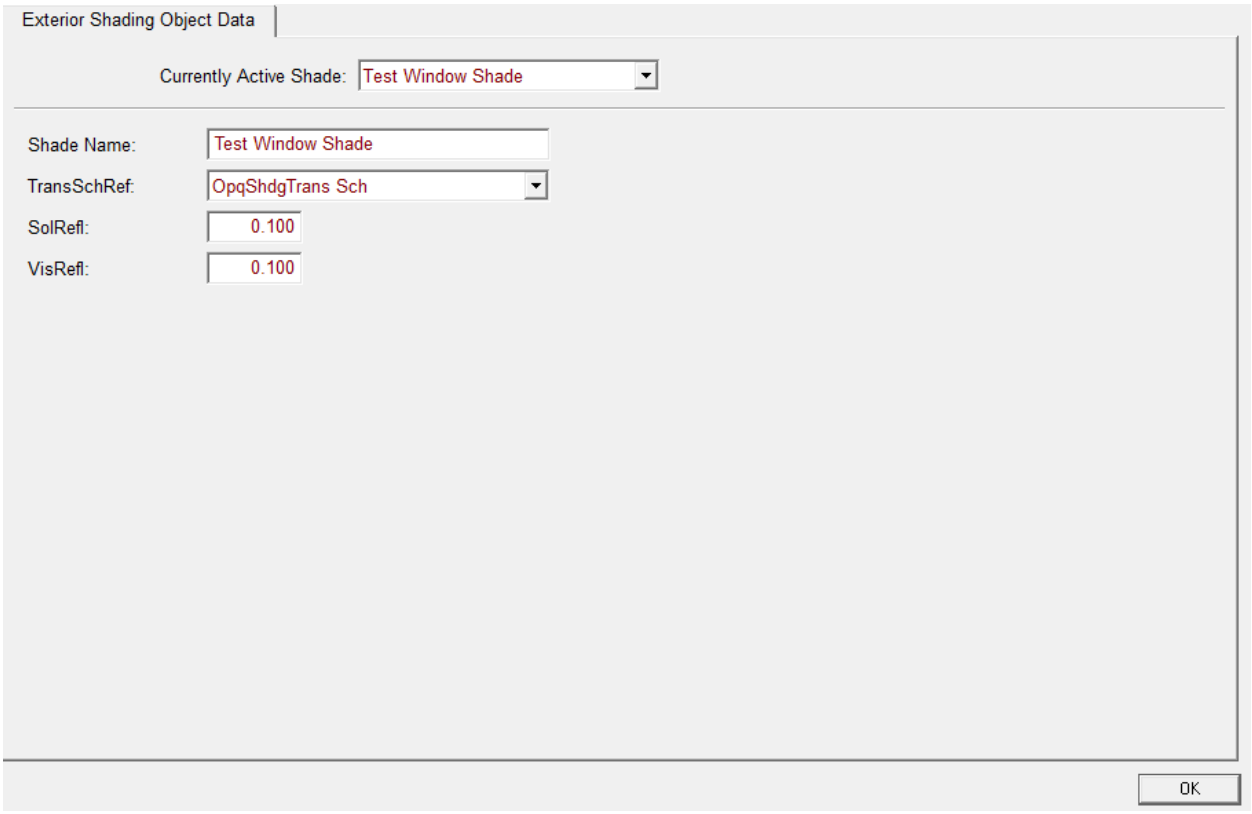
Input summary for **Fenestration Construction Data**:

- **Currently Active Fenestration Cons.:** The name of the currently selected fenestration construction.
- **Name**: The name of the Fenestration construction.
- **Fenes. Type**: This property determines whether the Fenestration Construction can be assigned to Vertical Glazing or Skylights.**Assm. Context**: Whether the Fenestration Product is Manufactured, Site Built or Field Fabricated.
- **Cert. Method**: Whether the Fenestration Construction represents and actual NFRC rated product or is based on T-24 Default Assumptions.
- **Greenhouse/Garden Window** (checkbox): This property identifies greenhouse/garden windows and allows for lookup of CEC default properties.
- **Skylt Glazing:** This property describes the skylight glazing material and allows for lookup of baseline performance parameters.
- **Skylt Curb:** This property describes the skylight curb configuration and allows for calculation of CEC default properties using the NA-6 calculation method.
- **Product Type:** This property describes the type of window or skylight and allows for lookup of CEC default and Standard Design properties.
- **Oper. Config.:** This property describes the configuration of operable windows and allows for lookup of CEC default properties. Possible Selections are:

    - Casement/Awning
- Sliding**Panes:** This property describes the window pane configuration and allows for lookup of CEC default properties.
- **Frame:** This property describes the window framing and allows for calculation of CEC default properties using the NA-6 calculation method.
- **Win. Divider:** This property describes the window divider configuration and allows for lookup of CEC default properties.
- **Tint:** This property describes the window tinting and allows for lookup of CEC default properties.
- **U-Factor**: The rate of heat transfer of the fenestration.
- **SHGC**: The fraction of solar energy transmitted through the fenestration.
- **Vis. Trans.:** The fraction of visible light transmitted through the fenestration.

Exterior Shading Object Data Screen

To access this screen, right click on Building and scroll down to **Create.** Then click **ExternalShadingObject.** Make selections in the **Create ExternalShadingObject** dialog box and click **OK.**

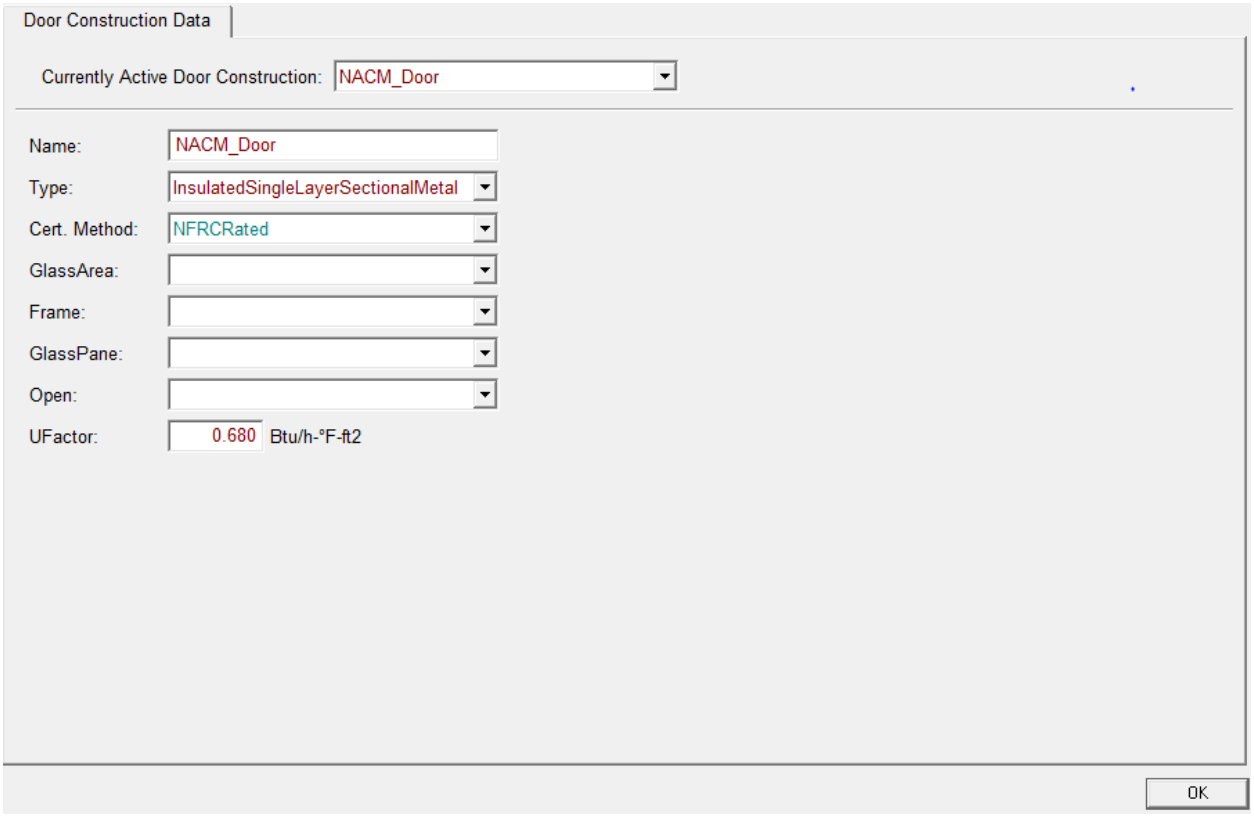


Input summary for **Exterior Shading Object Data** screen:

- **Currently Active Shade**: The name of the currently selected shade.
- **Shade Name**: The name or description used to identify the shade.
- **TransSchRef**: The schedule when the shade is in operation.
- **SolRefl**: The fraction of solar energy reflected by the shade.
- **VisRefl:** The fraction of visible light reflected by the shade.

Door Construction Data Screen

To access this screen, under Project name right click on **DoorConstructions** and scroll down to **Create**. Then click **DoorConstruction**. Make selections in the **Create DoorConstruction** dialog box, and click **OK.**

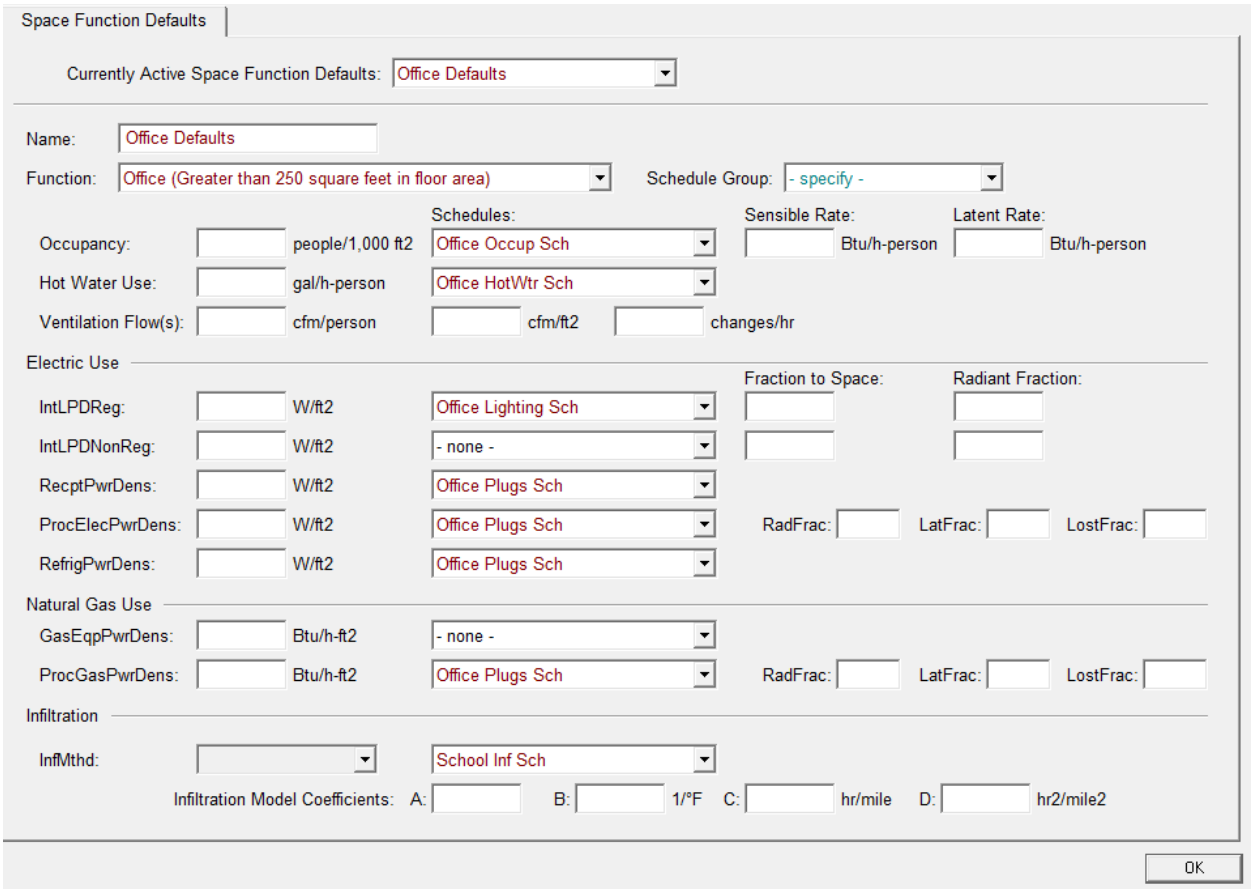


Input summary for **Door Construction Data**:

- **Currently Active Door Construction**: The name of the currently selected door construction.
- **Name:** The name or description used to identify the door construction.
- **Type**: The type of door. Options are InsulatedSingleLayerSectionalMetal, InsulatedSwingingMetal, UninsulatedDoubleLayerMetal, UninsulatedSingleLayerMetal, UninsulatedSingleLayerRollupMetal, WoodOther, and WoodThick.
- **Cert. Method:** The Certification Method – CECDefaultPerformance or NRFCRated.
- **GlassArea**: Defines the percentage of the door that is glazed.
- **Frame**: Defines the frame type of the door.
- **GlassPane:** Defines the glass pane type of the door.
- **Open:** Defines the exterior door operation.
- **UFactor**: The rate of heat transfer of the door.

Space Function Defaults Data Screen

To access this screen, under Project name expand **SpaceFunctionDefaults** and double click **Office Defaults.**


Space Function Defaults
Currently Active Space Function Defaults: Office Defaults
Name: Office Defaults
Function: Office (Greater than 250 square feet in floor area)
Schedule Group: - specify -
Schedules:
Sensible Rate:
Latent Rate:
Occupancy: people/1,000 ft2 Office Occup Sch Btu/h-person Btu/h-person
Hot Water Use: gal/h-person Office HotWtr Sch
Ventilation Flow(s): cfm/person cfm/ft2 changes/hr
Electric Use
Fraction to Space:
Radiant Fraction:
IntLPDReg: W/ft2 Office Lighting Sch
IntLPDNonReg: W/ft2 - none -
RecptPwrDens: W/ft2 Office Plugs Sch
ProcElecPwrDens: W/ft2 Office Plugs Sch RadFrac: LatFrac: LostFrac:
RefrigPwrDens: W/ft2 Office Plugs Sch
Natural Gas Use
GasEqpPwrDens: Btu/h-ft2 - none -
ProcGasPwrDens: Btu/h-ft2 Office Plugs Sch RadFrac: LatFrac: LostFrac:
Infiltration
InfMthd: School Inf Sch
Infiltration Model Coefficients: A: B: 1/°F C: hr/mile D: hr2/mile2
OK

Input summary for Space Function Defaults:

- **Currently Active Space Function Defaults**: The name of the active Space Function Defaults.
- **Name:** The name of the Space Function Defaults.
- **Function:** The area category occupancy type from Nonresidential Appendix 5.4A.
- **Schedule Group:** A type specifying occupancy categories used to determine schedules.
- **Occupancy:** The people per area in the space.
- **Hot Water Use:** The rate of domestic hot water used per person.
- **Ventilation Flow(s):** The rate of outdoor air supplied per person.
- **Schedules** (Occupancy): Reference to a schedule that describes the fraction of occupancy on an hourly basis.
- **Schedules** (HotWater use): Reference to a schedule that describes the fraction of hot water use on an hourly basis.
- **Sensible Rate**: The rate of sensible heat released per person, which is a function of activity.
- **Latent Rate:** The rate of latent heat released per person, which is a function of activity.

Electric Use section

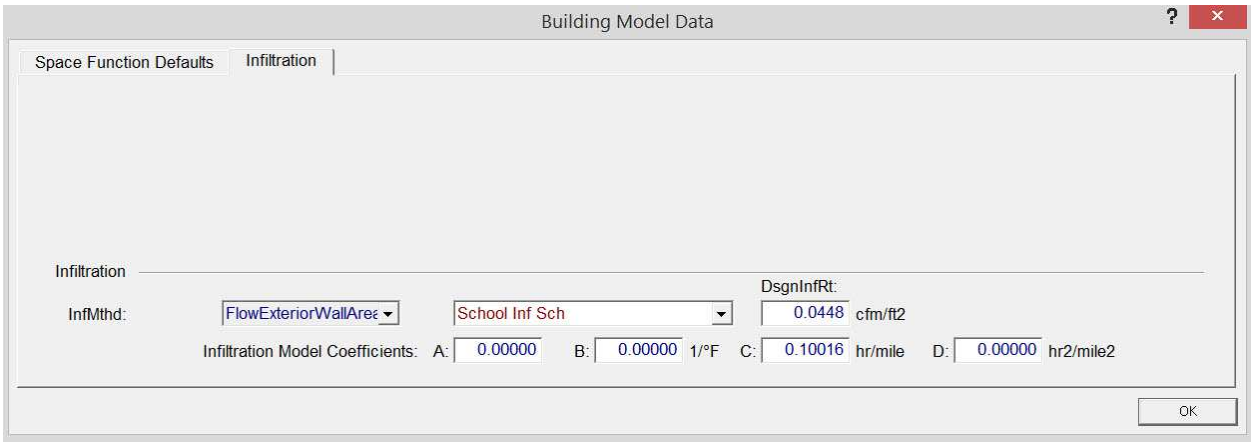
- **IntPDReg**: Total regulated connected lighting power density for all interior lighting systems in a Space. This includes the loads for lamps and ballasts.
- **Schedules** (IntPDReg): Reference to a schedule that describes the fraction of lighting use on an hourly basis.
- **Fraction to Space** (IntPDReg)**:** Fraction of regulated interior lighting heat gain going to space air.
- **Radiant Fraction** (IntPDReg)**:** Fraction of regulated interior lighting radiant heat gain going to space surfaces.
- **IntPDNonReg:** Total non-regulated connected lighting power density for all interior lighting systems in a Space. This includes the loads for lamps and ballasts.
- **Schedules** (IntPDNonReg): Reference to a schedule that describes the fraction of lighting use on an hourly basis.
- **Fraction to Space** (IntPDNonReg): Fraction of non-regulated interior lighting heat gain going to space air.
- **Radiant Fraction** (IntPDNonReg): Fraction of non-regulated interior lighting radiant heat gain going to space surfaces.
- **RecptPwrDens:** The usage of electrical devices plugged into receptacles in a space based on the occupancy type.
- **Schedules** (RecptPwrDens): Reference to a schedule that describes the fraction of receptacle use on an hourly basis.
- **ProcElecPwrDens**: Process electrical power density resulting from an activity or treatment not related to the space conditioning, lighting, service water heating, or ventilating of a building as it relates to human occupancy. Process load may include sensible and/or latent components. For data centers this includes transformers, UPS, PDU, server fans, power supplies, etc.
- **Schedules** (ProcElecPwrDens): Reference to a schedule that describes the fraction of receptacle use on an hourly basis.
- **RadFrac** (ProcElecPwrDens): The fraction of radiant heat gain to a space based on appliance energy use.
- **LatFrac** (ProcElecPwrDens)**:** The fraction of latent heat gain to a space based on appliance energy use.
- **LostFrac** (ProcElecPwrDens): The fraction of heat lost to the exterior is based on appliance energy use.
- **RfrgPwrDens:** The amount of power supplied to a unit area for refrigeration.
- **Schedules** (RfrgPwrDens): Reference to a schedule that describes the fraction of refrigeration use on an hourly basis.

Natural Gas Use section

- **GasEqpPwrDens**: Commercial gas power density is the average power density for all commercial gas equipment, assuming constant year-round operation.
- **Schedules** (GasEqpPwrDens): Reference to a schedule that describes the fraction of gas equipment use on an hourly basis.
- **ProcGasPwrDens:** Process load is the gas energy consumption in the conditioned space of a building resulting from an activity or treatment not related to the space conditioning, lighting, service water heating, or ventilating of a building as it relates to

human occupancy. Process load may include convective (sensible) and/or latent components.

- **Schedules** (ProcGasPwrDens): Reference to a schedule that describes the fraction of process gas equipment use on an hourly basis.
- **RadFrac** (ProcGasPwrDens): The fraction of radiant heat gain to a space based on appliance energy use.
- **LatFrac** (ProcGasPwrDens)**:** The fraction of latent heat gain to a space based on appliance energy use.
- **LostFrac** (ProcGasPwrDens): The fraction of heat lost to the exterior is based on appliance energy use.

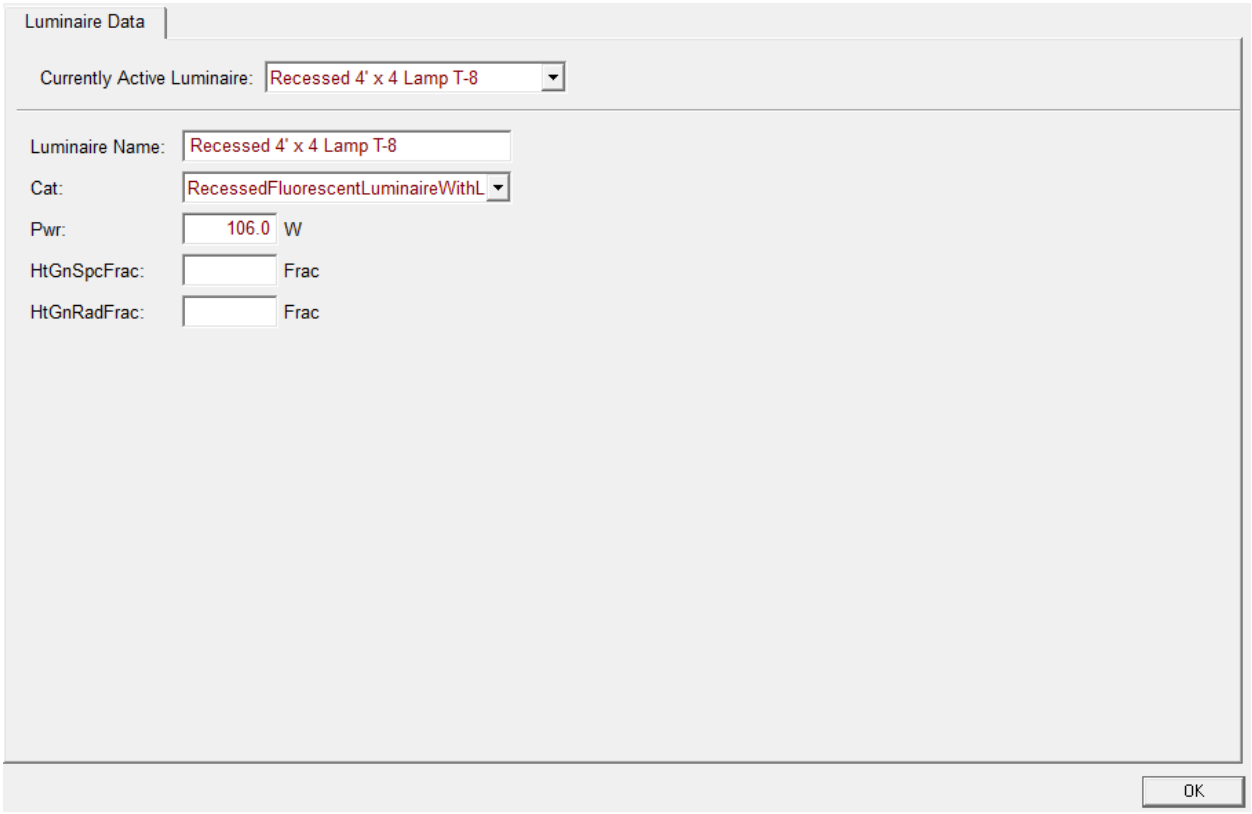


Infiltration tab

- **InfMthd**: Method used for modeling uncontrolled air leakage or infiltration. Options include FlowZone, FlowArea, FlowExteriorArea, FlowExteriorWallArea, and AirChangesPerHour.
- **DsgnInfRt**: The infiltration rate specified as cfm/ft² of exterior wall area at a wind speed of 10 mph and an infiltration schedule value of 1. The default value of 0.0448 cfm/ft² must be used unless specific air sealing methods beyond requirements of the standard are applied and documented.
- **Infiltration Model Coefficients: A:** Infiltration overall coefficient.
- **Infiltration Model Coefficients: B:** Infiltration temperature coefficient.
- **Infiltration Model Coefficients: C**: Infiltration windspeed coefficient.
- **Infiltration Model Coefficients: D**: Infiltration windspeed squared coefficient.

Luminaires Data Screen

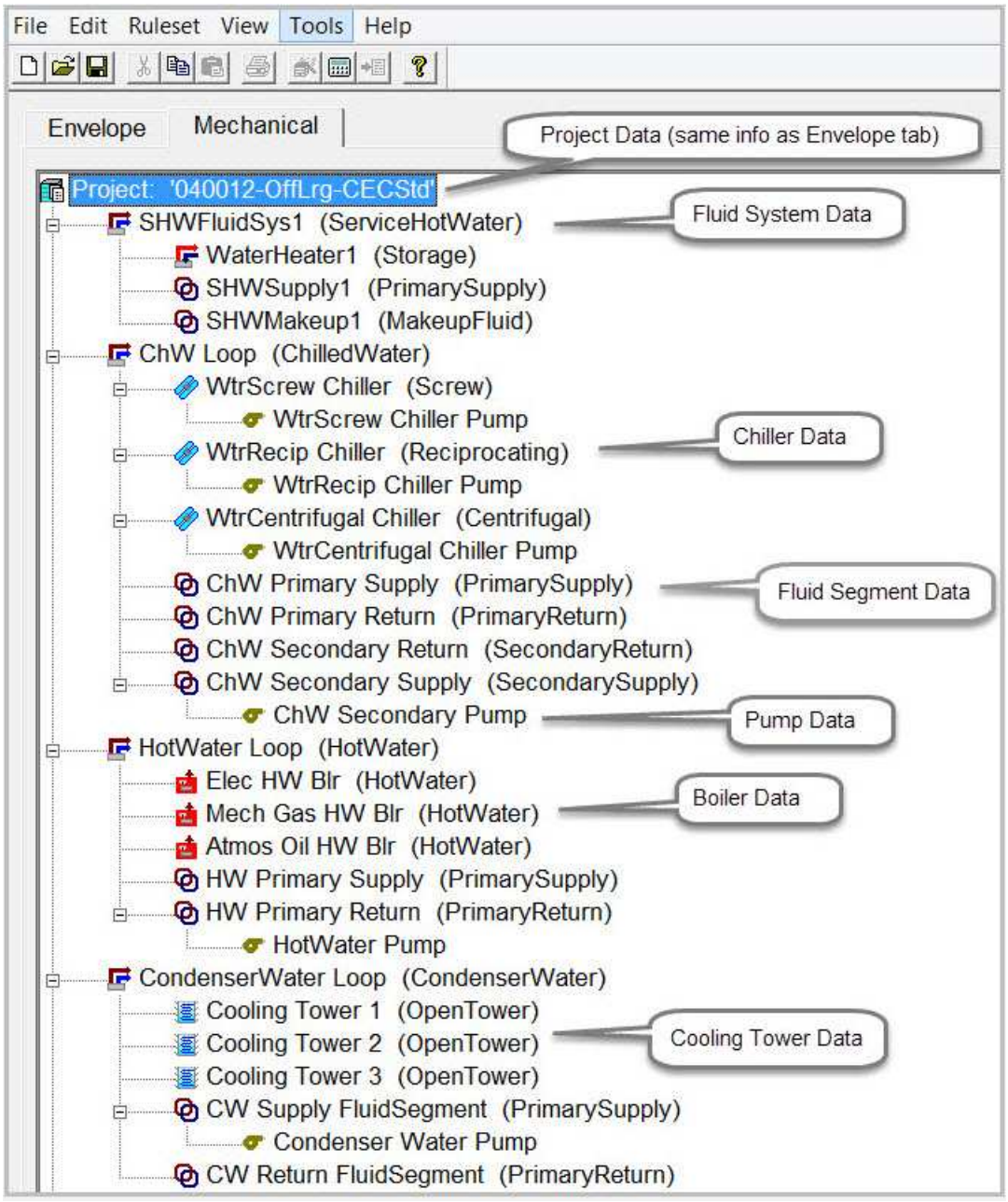
To access this screen, under the Project name expand **Luminaires** and double click the **Recessed** option.



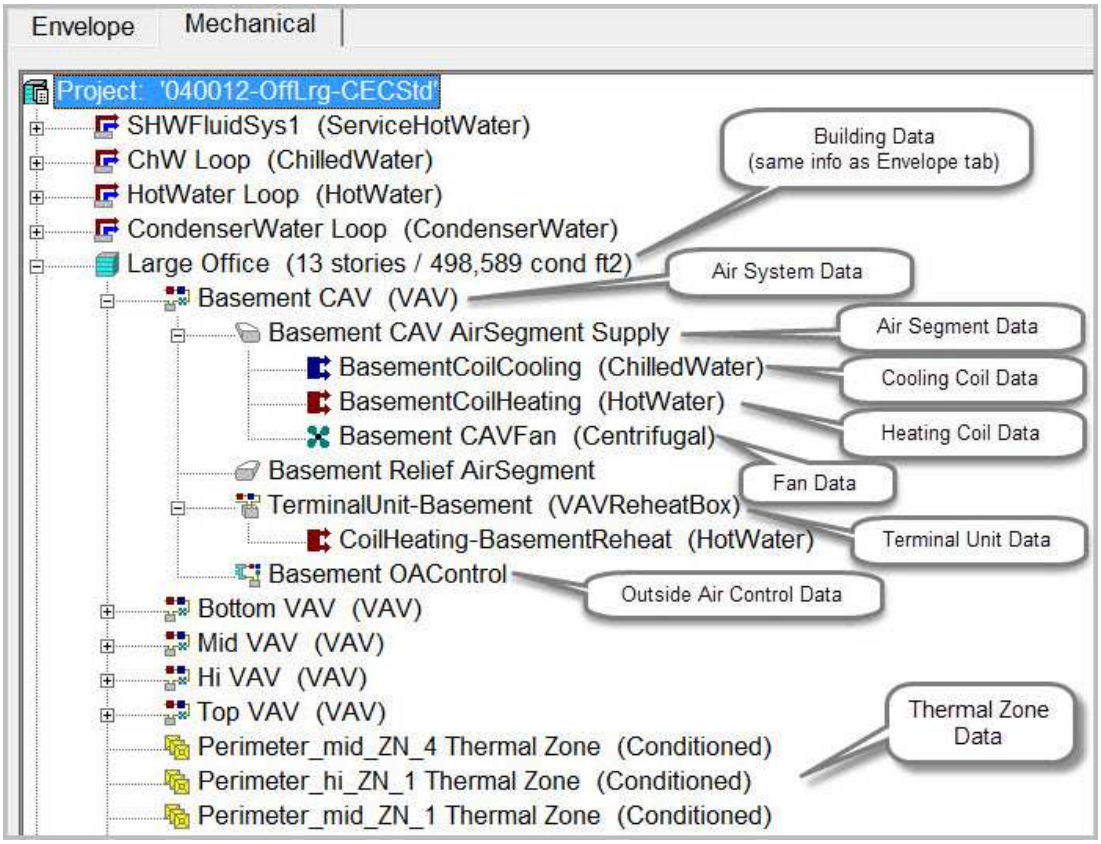
Input summary for Luminaires:

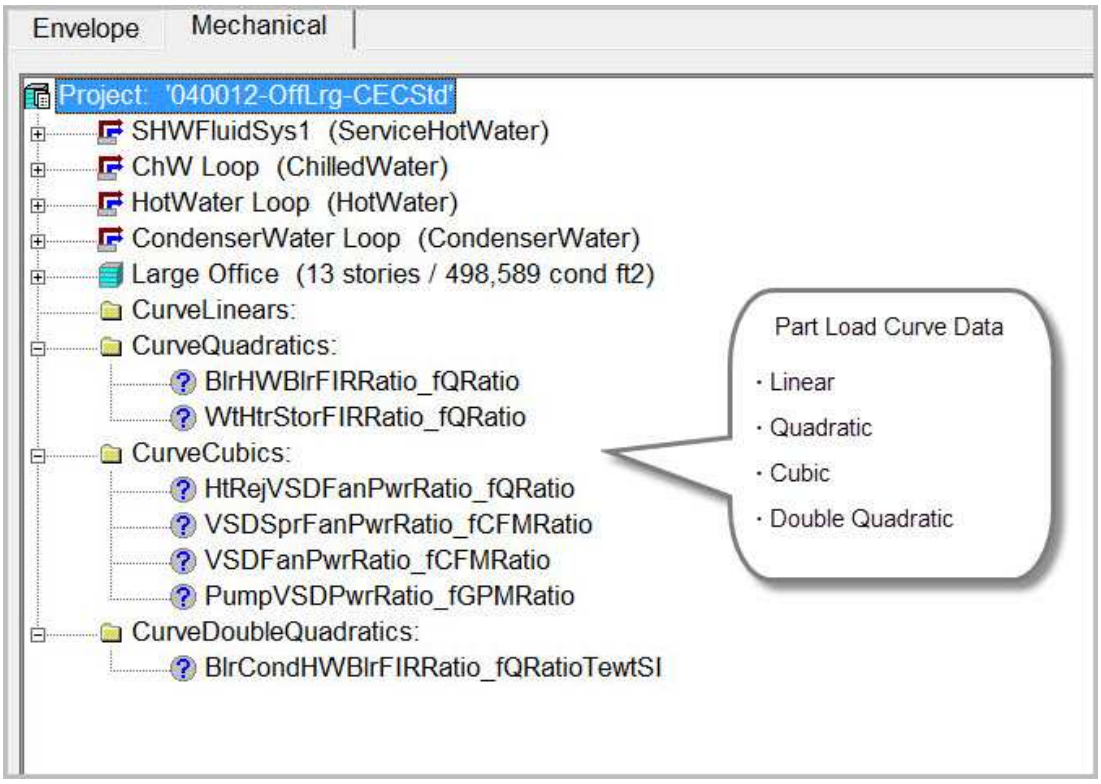
- **Currently Active Luminaire**: The name of the currently selected luminaire.
- **Luminaire Name**: The name of the luminaire.
- **Cat**: The type of luminaire used to determine heat gain distribution. Options are Downlight Compact Flourescent Luminaire, Downlight Incandescent Luminaire, NonInCeiling Flourescent Luminaire, RecessedFlourescentLuminairewithLens and RecessedFlourescentLuminairewithoutLens.
- **Pwr**: Luminaire power: The Connected power for a luminaire including lamp and ballast.
- **HtGnSpcFrac**: Fraction of luminaire heat gain going to space air.
- **HtGnRadFrac**: Fraction of luminaire radiant heat gain going to space surfaces.

Organization of the Mechanical Tab



Organization of the Mechanical Tab (continued)



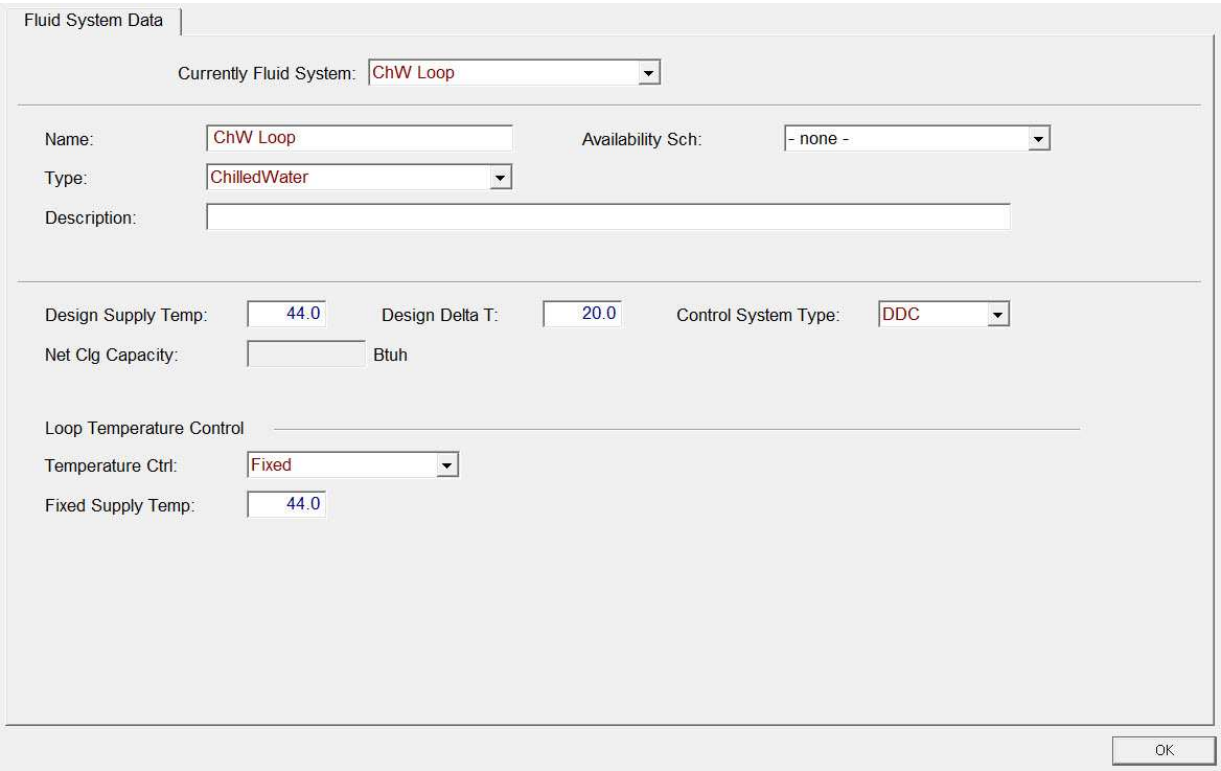


Mechanical Input Screen Details

Project Data Screen

Note that the Project Data input screen is identical to that described above in the Envelope Input Screen Details. Users may edit Project Data on either the Envelope or Mechanical tab of the user interface and that data will persist on both tabs.

Fluid System Data Screen



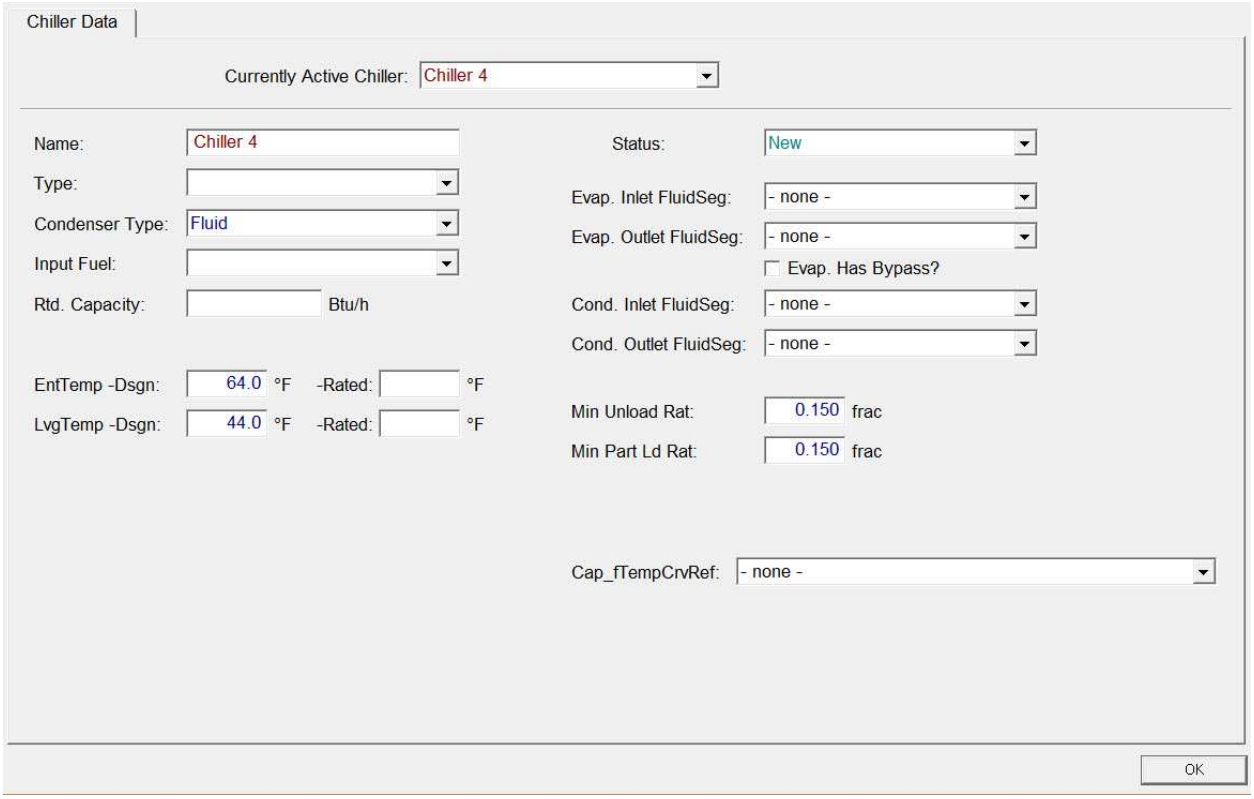
Input Summary:

- **Currently Fluid System:** Name of the currently selected fluid system.
- **Name**: The name of the fluid system.
- **Type**: The type of fluid segment.
  The type is used to validate the connections between various FluidSys objects.
- **Description**: A brief description of the fluid system that summarizes its essential characteristics.
- **Availability Sch**: The name of the schedule that determines when the hot water system is available to provide heating. The system is not necessarily providing heating at all times it is available, but if it is not available, no heating will be provided.
- **Design Supply Temp**: The design supply water temperature of the loop
- **Design Delta T**: The design supply water temperature delta T.
- **Control System Type**: The type of control system used for the fluid system - DDC or other. This is used to specify part load curves for variable speed pumps.
- **Net Clg Capacity**:

Loop Temperature Control section

- **Temperature Crtl**: The method used to control the chilled water supply temperature. The options are Fixed, Scheduled, OutsideAirReset and WetBulbReset.
    - Fixed means that a constant temperature setpoint is used.
    - Scheduled means that the temperature is adjusted based on a user specified schedule.
    - OutsideAirReset means that the water supply temperature is adjusted based on the outdoor air temperature.
    - WetBulbReset reset means that the water supply temperature is adjusted based on the cooling load.
- **Fixed Supply Temp**: The supply water temperature setpoint for 'Fixed' temperature control

Chiller Data Screen

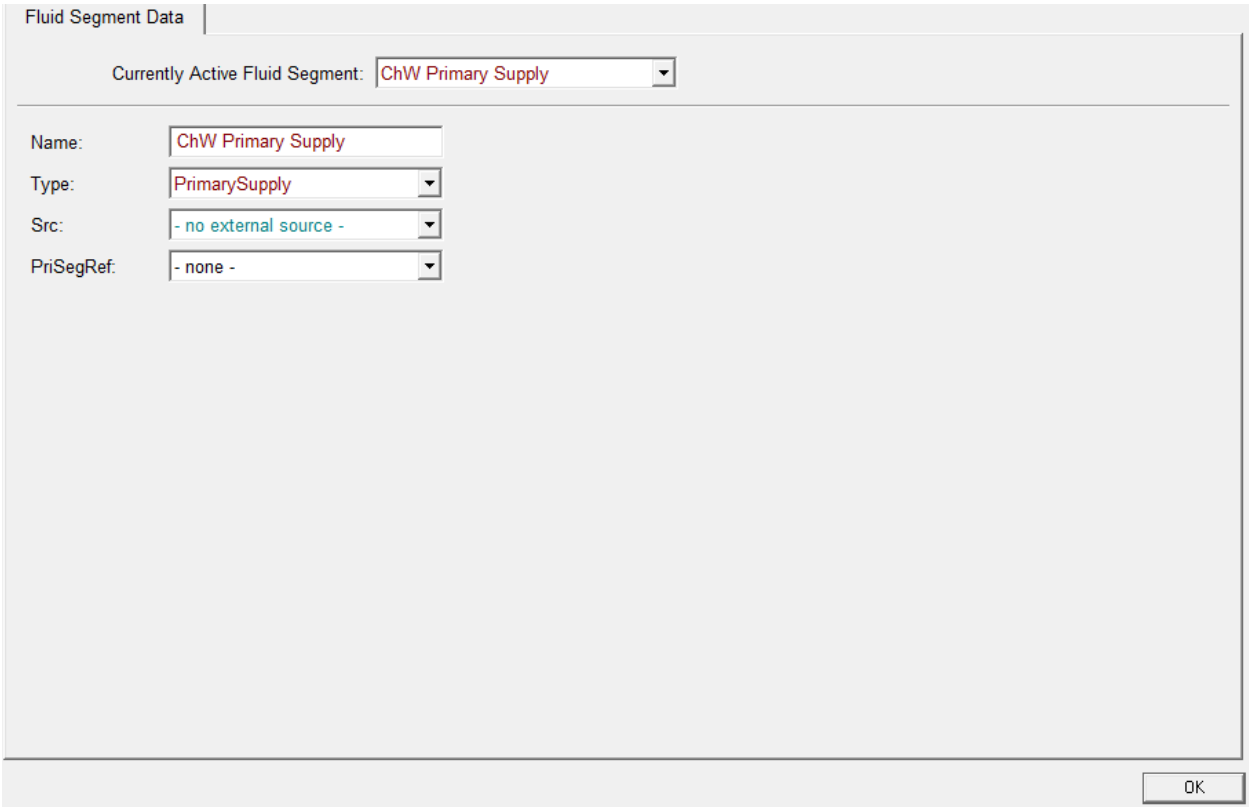

Chiller Data
Currently Active Chiller: Chiller 4
Name: Chiller 4
Type:
Condenser Type: Fluid
Input Fuel:
Rtd. Capacity: Btu/h
EntTemp -Dsgn: 64.0 °F -Rated: °F
LvgTemp -Dsgn: 44.0 °F -Rated: °F
Status: New
Evap. Inlet FluidSeg: - none -
Evap. Outlet FluidSeg: - none -
Evap. Has Bypass?
Cond. Inlet FluidSeg: - none -
Cond. Outlet FluidSeg: - none -
Min Unload Rat: 0.150 frac
Min Part Ld Rat: 0.150 frac
Cap_fTempCrvRef: - none -
OK

Input Summary:

- **Currently Active Chiller**: The name of the currently selected chiller.
- **Name**: The name of the chiller.
- **Type**: The type of chiller being used based on the compressor type or absorption process. The type of chiller selected from a list: Centrifugal, Reciprocating, Scroll, Screw, Heat Recovery, Heat Pump, Single Effect Absorption, Double Effect Absorption, Triple Effect Absorption. Note that the heat rejection process is not included in the Type descriptor. See Condenser Type.
- **Condenser Type:** Method used to reject heat from the chiller.
  Air-cooled chillers use air to cool the condenser coils. Water-cooled chillers use cold water to cool the condenser and additionally need either a cooling tower or a local source of cold water. Evaporatively cooled chillers are similar to air-cooled chillers, except they use a water mist to cool the condenser coil, which makes them more efficient.
- **Input Fuel:** The form of the primary energy input to the chiller.
  All chillers have a primary energy input along with electricity use for auxiliaries. This input describes the form of the primary energy. Options are Electricity, Steam, Hot Water, Natural Gas, or Oil.
- **Rtd. Capacity:** The cooling capacity of the chiller at rating conditions.
  The full load output of the chiller operating at rating temperatures and flows.
- **EntTemp -Dsgn:** The chilled water return temperature at design conditions.
  This temperature is used to size the chilled water components of the system.
- **(EntTemp) -Rated:** Rated chilled water entering temperature.

- **LvgTemp -Dsgn:** The chilled water supply temperature at design conditions.
  This temperature is used to size the chilled water components of the system.
- **(LvgTemp) -Rated**: Rated chilled water leaving temperature.
- **Status:** Defines if equipment is new, existing or modified.
- **Evap. Inlet FluidSeg**: Name of the fluid segment connected to the evaporator inlet. This is the chiller evaporator inlet connection, to chilled water return.
- **Evap. Outlet FluidSeg:** Name of the fluid segment connected to the evaporator outlet. The chiller condenser outlet connection, to condenser water return.
- **Evap. Has Bypass?** Whether or not the chiller has Bypass.
- **Cond. Inlet FluidSeg:** Name of the fluid segment connected to the condenser inlet. This is the chiller condenser inlet connection, to condenser water supply
- **Cond. Otlet FluidSeg:** Name of the fluid segment connected to the condenser outlet. This is the chiller condenser outlet connection, to condenser water return
- **Min Unload Rat:** Minimum unloading ratio
- **Min Part Ld Rat:** Minimum part load ratio
- **Cap_fTempCrvRef**: The name of the performance curve which describes the chiller cooling capacity as a function of operating temperatures.
  For water cooled chillers the temperatures are the leaving chilled water and entering condenser water temperature. For air cooled chillers the temperatures are the leaving chilled water temperature and the outdoor air drybulb.

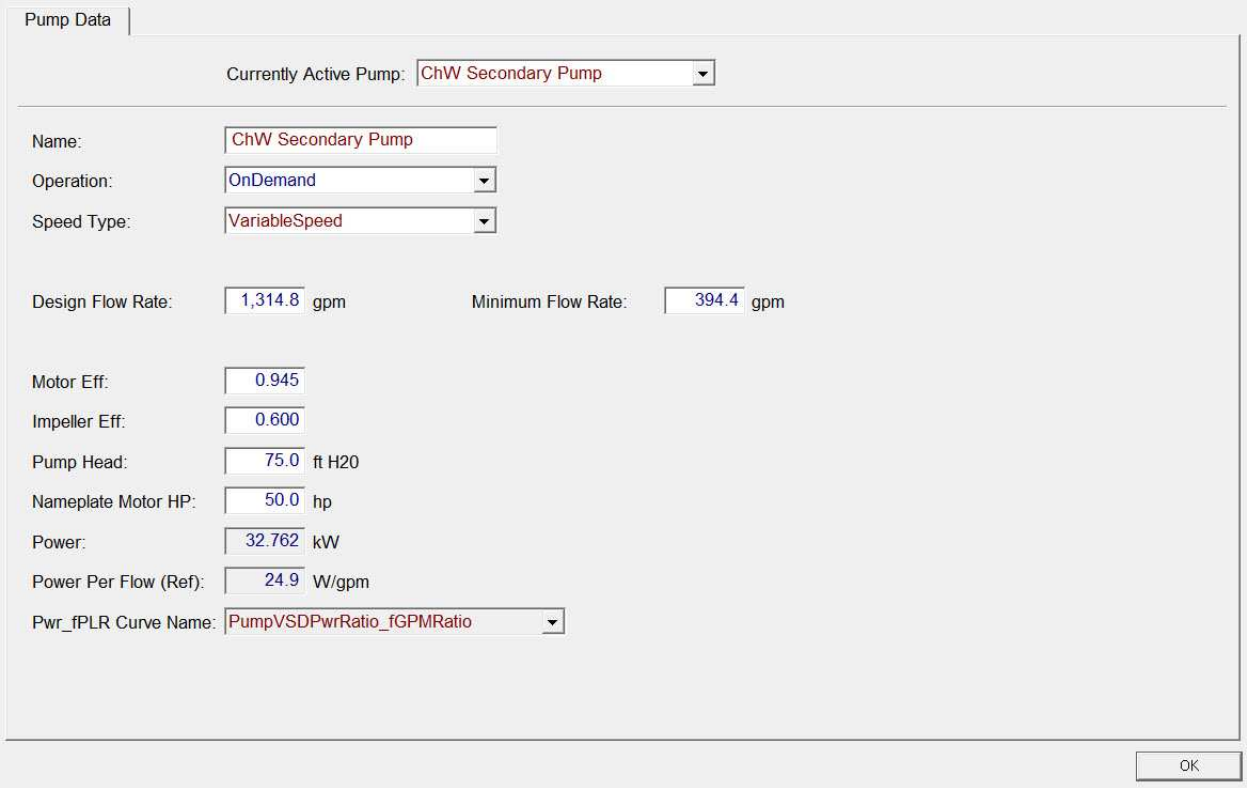
Fluid Segment Data Screen



Input Summary:

- **Currently Active Fluid Segment:** The name of the currently selected fluid segment.
- **Name**: The name of the fluid segment.
- **Type**: The type of fluid segment. It is used to validate the connections between various FluidSys objects. Options include PrimarySupply, PrimaryReturn, SecondarySupply, SecondaryReturn, MakeupFluid and Connector.
- **Src:** The source of the Fluid Segment. Available options are No external source and MunicipalWater.
- **PriSegRef**: Refers to the segment that supplies fluid to a secondary segment. Applicable to fluid loops subordinate to the primary loop (secondary, tertiary, etc.), this property is used to define the inlet and outlet of secondary segment.

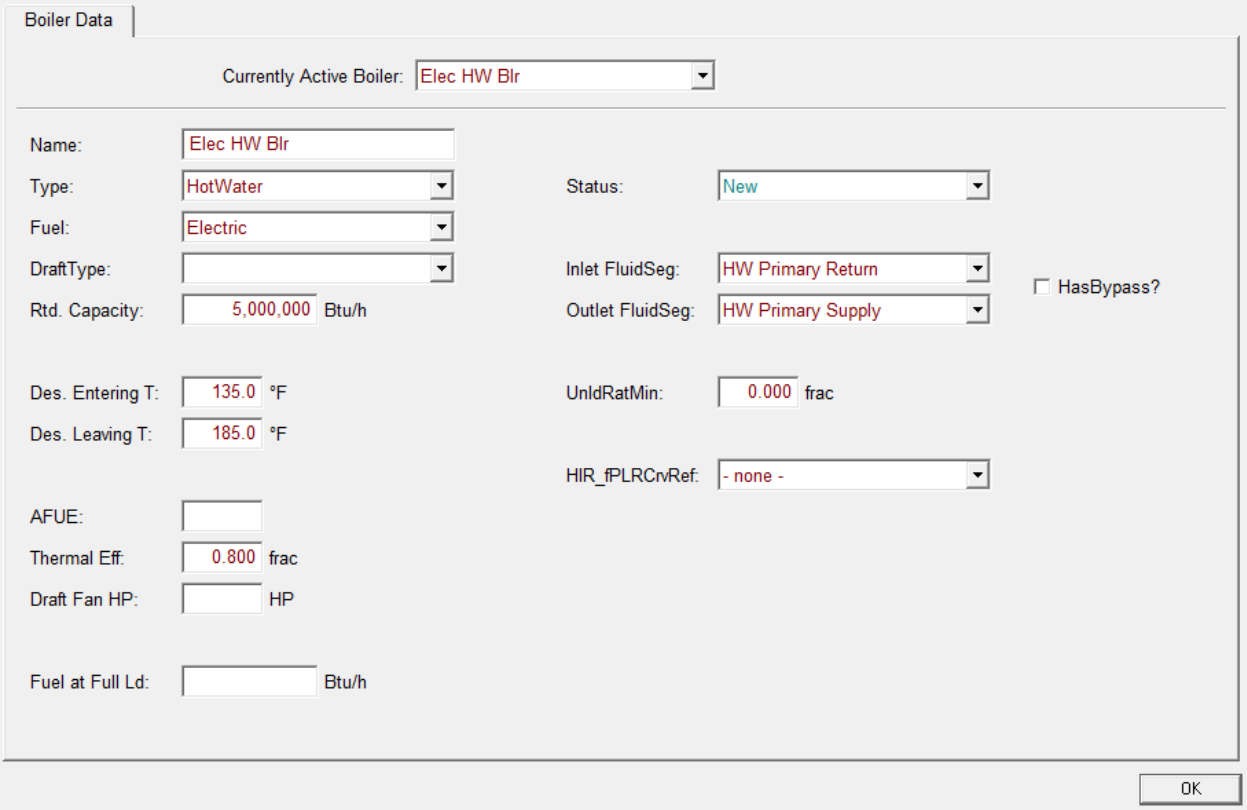
Pump Data Screen



Input Summary:

- **Currently Active Pump**: The name of the currently selected pump.
- **Name**: The name of the pump.
- **Operation:** The type of system the pump will be operating in.
- **Speed Type**: Selection allows for constant or variable speed pump.
- **Design Flow Rate**: The capacity of the pump.
- **Minimum Flow Rate**: The lowest flow rate available for the pump.
- **Motor Eff:** Indicates how well the motor converts electrical power into mechanical power and is defined as output power divided by input power expressed as a ratio.
- **Impeller Eff:** Full load efficiency of the pump impeller.
- **Pump Head:** The pressure head of the pump at design flow conditions.
- **Nameplate Motor HP:** The nameplate horsepower of the pump motor.
- **Power:** The design power of the pump. This inputs gets calculated by the software based on user inputs for other pump parameters.
- **Power Per Flow (Ref):** The power of the pump per unit flow at design flow capacity.
- **Pwr_fPLR Curve Name:** The name of the power as a function of PLR curve. This is normally a biquadratic curve.

Boiler Data Screen

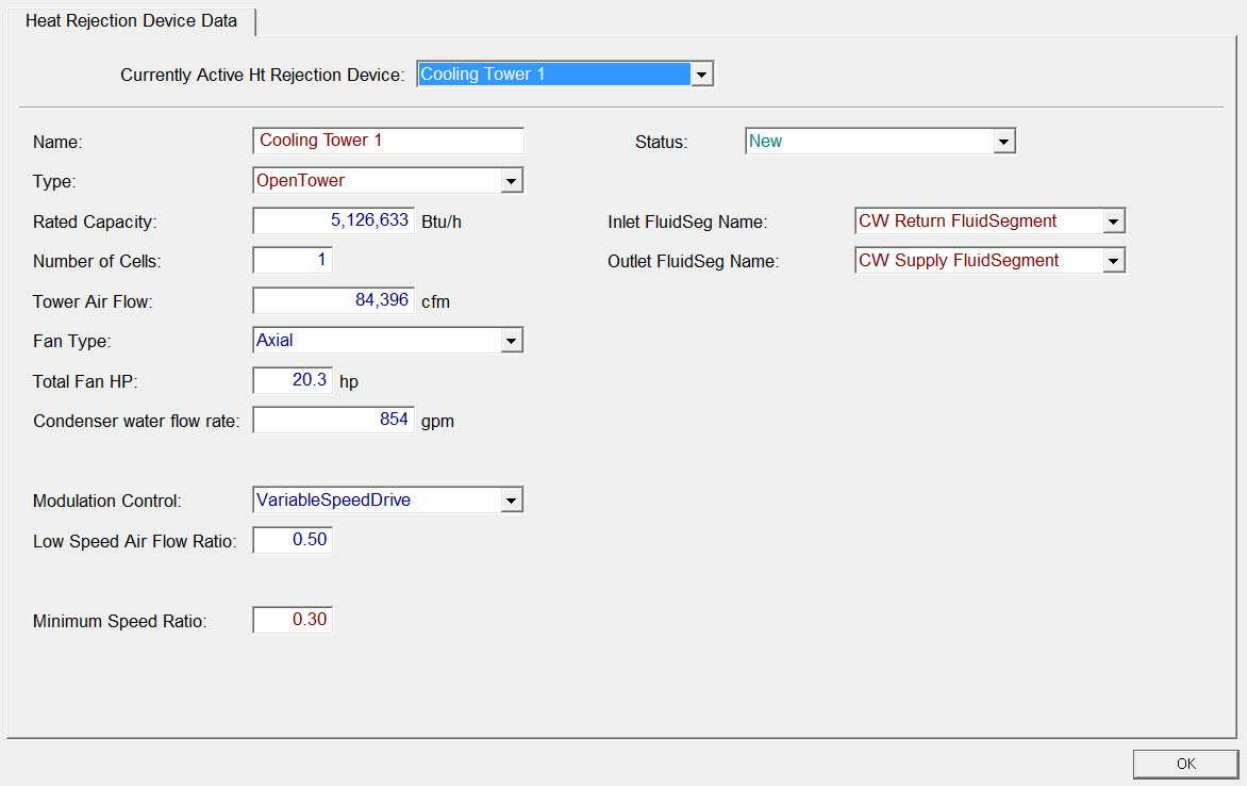


Input Summary:

- **Currently Active Boiler:** The name of the currently selected boiler.
- **Name:** The name of the boiler.
- **Type**: Type of boiler in terms of steam or hot water. Boiler type in terms of fuel used or draft type are defined in other descriptors and rules.
- **Fuel**: The primary fuel used by the boiler to generate heat. Options are gas, oil or electric.
- **Draft Type**: Draft type for fuel fired boilers. Options include Mechanical and Natural.
- **Rtd. Capacity:** Heat output of the boiler at full load and rated conditions.
- **Des. Entering T**: The temperature of the hot water returned to the boiler at design conditions. This may not be the return water temperature during normal operation.
- **Des. Leaving T**: The temperature of the hot water supplied by the boiler at design conditions. This may not be the supply water temperature during normal operation.
- **AFUE**: The Annual Fuel Utilization Efficiency of the boiler. Applies only to smaller gas, propane, or oil fired boilers with output heating capacities of less than 300,000 Btu/hr. For larger fuel-fired boilers, use thermal efficiency, and for electric boilers use EIR.
- **Thermal Eff:** The Thermal Efficiency of the boiler. Applies only to larger gas, propane or oil fired boilers with output heating capacities of 300,000 Btu/hr or more. For smaller fuel-fired boilers use AFUE. For electric boilers use EIR.
- **Draft Fan HP**: The nameplate horsepower of the draft fan motor for boilers with mechanical draft.
- **Fuel at Full Ld**: The fuel consumption at design conditions.

- **Status**: Defines if equipment is new, existing or modified.
- **Inlet FluidSeg:** The boiler inlet connection, to hot water return, or HWR.
- **Outlet FluidSeg**: The boiler outlet connection, to hot water supply, or HWS.
- **UnldRatMin**: The minimum load on the boiler at which the boiler can operate without cycling, expressed as a fraction of the full load capacity. At loads less than this, the boiler cycles at the minimum capacity as needed to meet the load.
- **HIR_fPLRCrvRef**: The name of the performance curve which modifies the boiler efficiency (heat input ratio) for the time step as a function of the part load ratio.
- **HasBypass?** (checkbox): Whether or not the Boiler has Bypass.

Heat Rejection Device Data Screen


Heat Rejection Device Data
Currently Active Ht Rejection Device: Cooling Tower 1
Name: Cooling Tower 1
Status: New
Type: OpenTower
Rated Capacity: 5,126,633 Btu/h
Inlet FluidSeg Name: CW Return FluidSegment
Number of Cells: 1
Outlet FluidSeg Name: CW Supply FluidSegment
Tower Air Flow: 84,396 cfm
Fan Type: Axial
Total Fan HP: 20.3 hp
Condenser water flow rate: 854 gpm
Modulation Control: VariableSpeedDrive
Low Speed Air Flow Ratio: 0.50
Minimum Speed Ratio: 0.30
OK

Input Summary:

- **Currently Active Ht Rejection Device**: The name of the currently selected heat rejection device.
- **Name:** The name of the heat rejection device.
- **Type:** The type of heat rejection device.
  Heat rejection devices include cooling towers and ground source types. The available options are OpenTower, ClosedTower, GroundSourceHeatExchanger, Lake and Well
- **Rated Capacity**: The rated cooling capacity at CTI test conditions.
  The cooling capacity at rated conditions of 95°F condenser water return, 85°F condenser water supply, and 78°F wet-bulb with a 3 gpm/nominal ton water flow, where a nominal ton is 15,000 Btu/hr.
- **Number of Cells**: The number of cells in the cooling tower. Each cell has its own fan and water flow allowing for responding to lower load conditions.
  Each cell will be modeled as equal size. Cells are subdivisions of cooling towers into individual cells, each with their own fan and water flow, allowing the cooling system to respond more efficiently to lower load conditions.
- **Tower Air Flow**: The rate of air moving through the tower.
- **Fan Type:** The type of fan used in a cooling tower.
  Fan type options are axial or centrifugal.
- **Total fan HP**: The sum of the nameplate rated horsepower (hp) of all fan motors on the cooling tower.
- **Condenser water flow rate:** The rate of water flowing through the condenser.

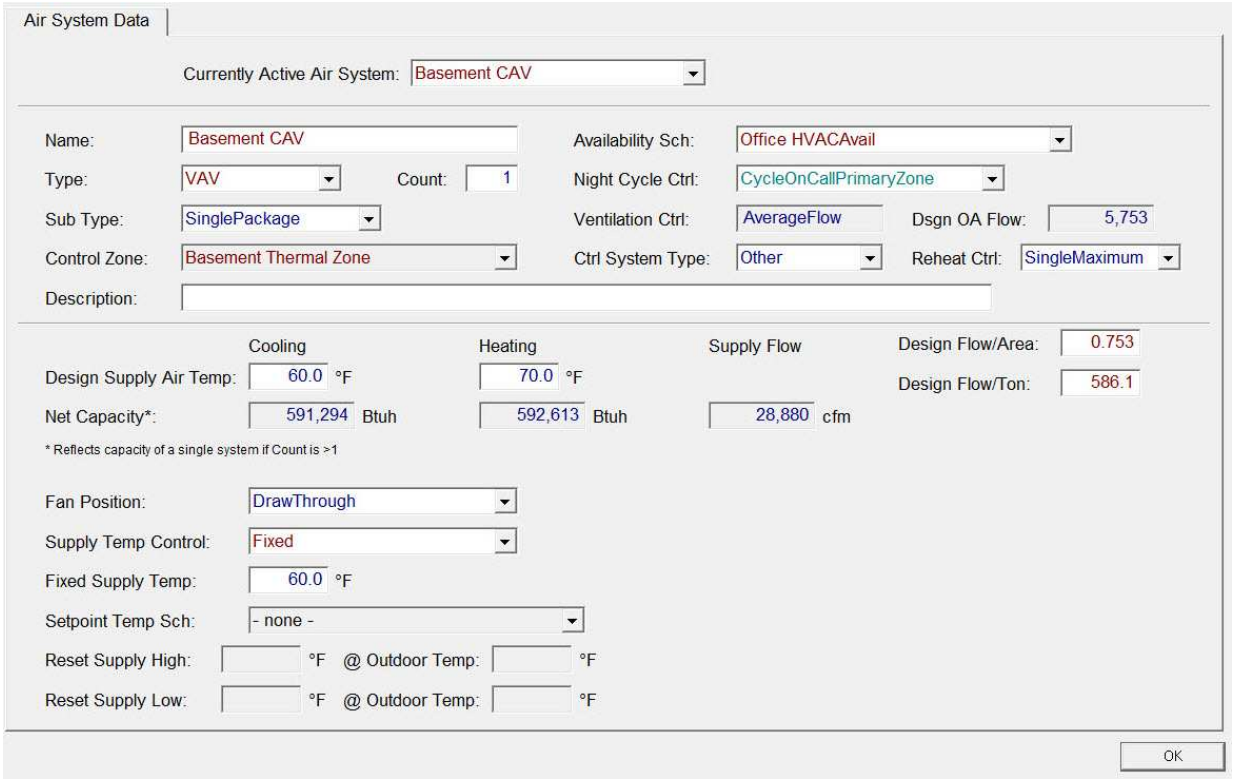
- **Modulation Control:** The method used by the heat rejection device to modulate capacity.
- **Low Speed Air Flow Ratio:** Ratio of the low-speed airflow to full speed airflow. The percentage full load airflow that the tower has at low speed or with the pony motor operating. This is equivalent to the percentage full load capacity when operating at low speed.
- **Minimum Speed Ratio**: Minimum fan speed for a variable speed tower. The minimum fan speed setting of a VSD controlling a cooling tower fan expressed as a ratio of full load speed.
- **Status:** Defines if equipment is new, existing or modified.
- **Design Entering Water Temp.:** The temperature of the condenser water leaving the cooling tower at design conditions. This is set equal to the lesser of 85°F or 10°F above the design wet-bulb temperature.
- **Design Leaving Water Temp.:** Cooling Tower Design Return Water Temperature. The design condenser water return temperature (entering tower) that was used for selection and sizing of the cooling tower.
- **Inlet FluidSeg Name:** The heat rejection inlet connection, to condenser water return, or CWR.
- **Outlet FluidSeg Name**: The heat rejection outlet connection, to condenser water supply, or CWS.

Building Data Screen

Note that Building Data input screen is identical to that described above in the Envelope Input Screen Details. Users may edit Building Data on either the Envelope or Mechanical tab of the user interface and that data will persist on both tabs.

See the Building Data Screen above in the Envelope tab for details.

Air System Data Screen



Input Summary:

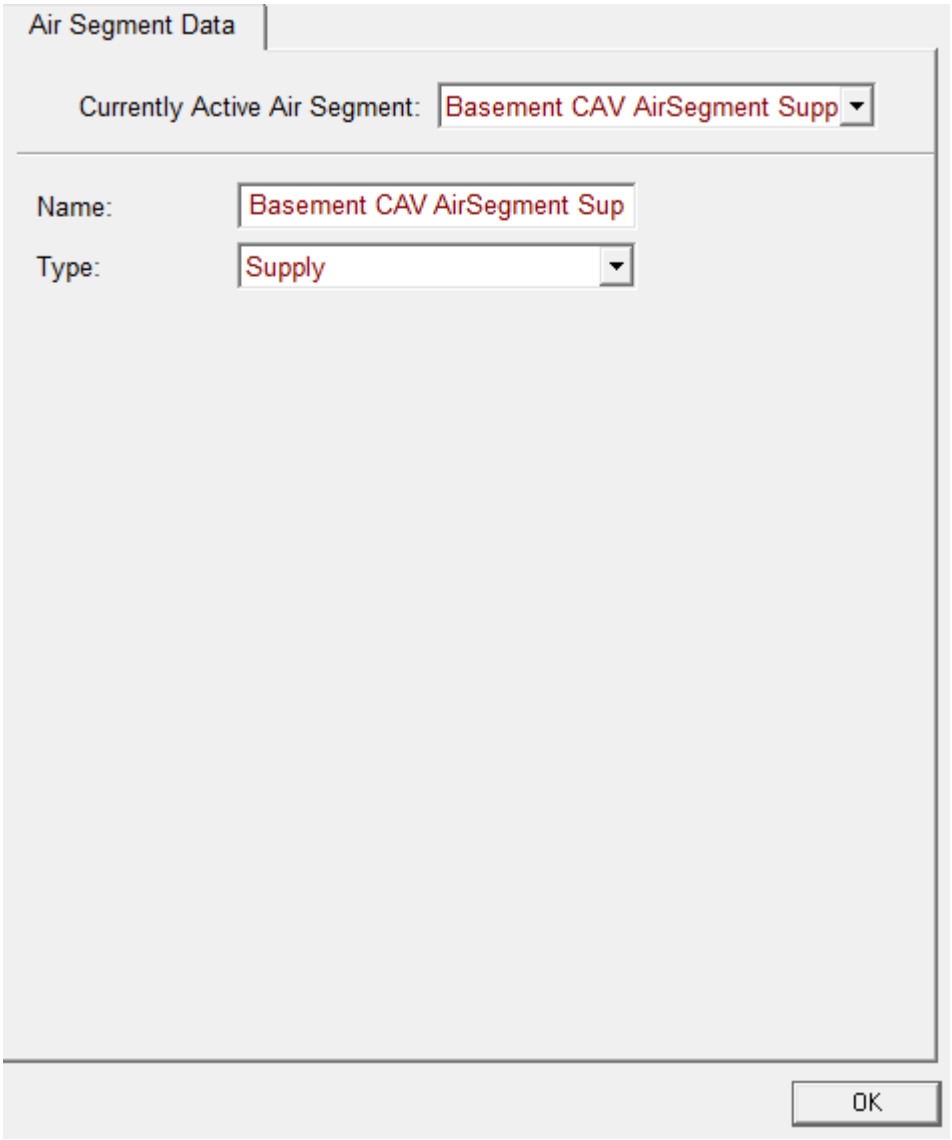
- **Currently Active Air System:** The name of the currently selected Air System.
- **Name:** The name of the Air System.
- **Type**: A unique descriptor that identifies high level attributes of a HVAC system. Options available are PVAV, VAV, SZAC, SZHP, SZVAVAC, SZVAVHP and HV.
- **Count**: The number of duplicate systems represented by the current system. The number of duplicate systems can only be >1 when all attributes of the system are the same. If Count is specified to be >1, all parameters (capacities, power, etc.) should be specified for the single piece of equipment. The ruleset applies multipliers for the final simulation.
- **Sub Type:** Property used to define rating conditions and efficiency requirements of system components. Options available are Single Package and Split System.
- **Control Zone**: A reference to the Thermal zone name where controls for the Air System are located.
- **Description:** A brief description of the Air System that summarizes its essential characteristics.
- **Availability Sch**: Name of the Availability schedule for the Air System.
- **Night Cycle Ctrl**: The HVAC system control method when heating, cooling and fan systems are scheduled to be Off. For this control, the space is controlled to the setback or setup temperature only; this control is not equivalent to night purge control. Options for Night Cycle Fan Control include CycleOnCallAnyZone, CycleOnCallPrimaryZone, CycleZoneFansOnly and StaysOff.
- **Ventilation Ctrl:** Options are AverageFlow and CriticalZone.

- **Dsgn OA Flow:** The design outside air flow of the AirSytem in cfm
- **Ctrl System Type:** The type of control system used for an HVAC system. Applicable to multizone HVAC systems and their related equipment only. This input affects the proposed design system specification for zone level controls, supply air temperature reset controls, ventilation controls and fan and pump static pressure part-load curves.
- **Reheat Ctrl:** The air/temperature control strategy for VAV reheat box in heating mode.
    - Single Maximum: The airflow is set to a minimum constant value in both the deadband and heating mode. The minimum airflow septoint is typically 30 to 50 percent of maximum. This control mode typically has a higher minimum airflow than the minimum used in the dual maximum below, resulting in more frequent reheat.
    - Dual Maximum: raises the SAT as the first stage of heating, and increases the airflow to the zone as the second stage of heating, as follows:
      1. The first stage of heating consists of modulating the zone supply air temperature setpoint up to a maximum setpoint no larger than 95°F while the airflow is maintained at the deadband flow rate.
      2. The second stage of heating consists of modulating the airflow rate from the deadband flow rate up to the heating maximum flow rate (50 percent of design flow rate).
- **Design Supply Air Temp** (Cooling): The design cooling supply air temperature of single duct system or the cold duct of a dual duct system. This is also the control setpoint for Fixed air temperature control.
- **Design Supply Air Temp** (Heating): The design heating supply air temperature of single duct system or the hot duct of a dual duct system. This is also the control setpoint for 'Fixed' air temperature control.
- **Net Capacity** (Cooling): Net Capacity of the Cooling System
- **Net Capacity** (Heating): Net capacity of the Heating System.
- **Net Capacity** (Supply Flow):The capacity of the supply fan in cfm
- **Design Flow/Area:**Air flow per sq ft of area for auto hardsizing the system
- **Design Flow/Ton:** Air flow per net cooling ton for auto hardsizing the system
- **Fan Position:** The position of the supply fan relative to the cooling coil.
- **Supply Temp Control**: The method of controlling the supply air temperature of a single duct system, or the cold duct of dual duct system.
- **Fixed Supply Temp**: The temperature of the air being supplied to the space.
- Setpoint Temp. Sch: The scheduled supply air temperature setpoint of a single duct air system, or the scheduled setpoint temperature of the cold duct in a dual duct system.
- **Reset Supply High:** The maximum (high) reset supply air temperature for a single duct system, or for the cold duct of a dual duct system.
  If supply air temperature is reset based on outside air temperature, specifies the supply air high setpoint to at the outside drybulb low. If supply air temperature is reset based on 'Warmest' zone, specifies the maximum supply air temperature for reset.
- **@ Outdoor Temp** (High): The minimum (low) outdoor air temperature at the high reset supply air temperature during cooling. Applicable when cooling supply air temperature is reset based on outside air temperature, specifies the outside drybulb low.
- **Reset Supply Low:** The minimum (low) reset supply air temperature during cooling. If cooling supply air temperature is reset based on outside air temperature, specifies the supply air low setpoint to at the outside drybulb high. If cooling supply air temperature

is reset based on warmest zone, specifies the minimum supply air temperature for reset.

- **@ Outdoor Temp** (Low): The maximum (high) outdoor air temperature at the low reset supply air temperature during cooling. If cooling supply air temperature is reset based on outside air temperature, specifies the supply air low setpoint to at the outside drybulb high.

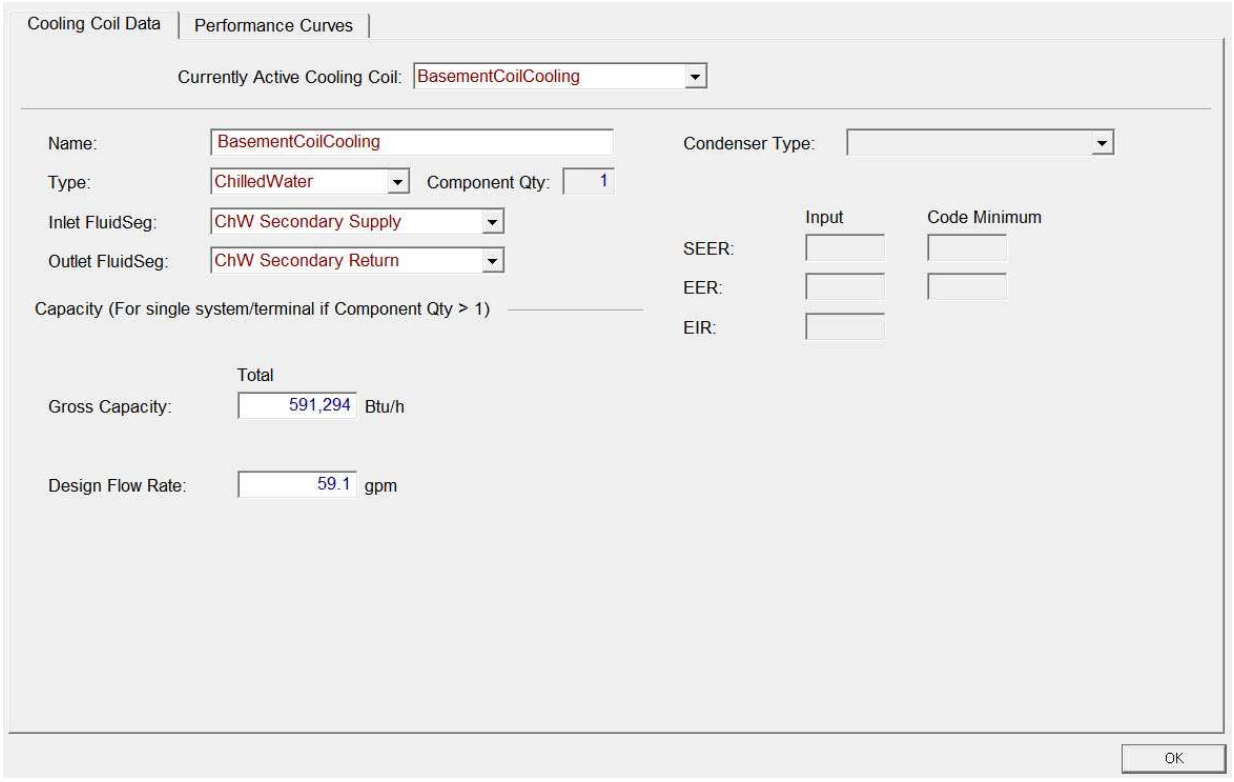
Air Segment Data Screen



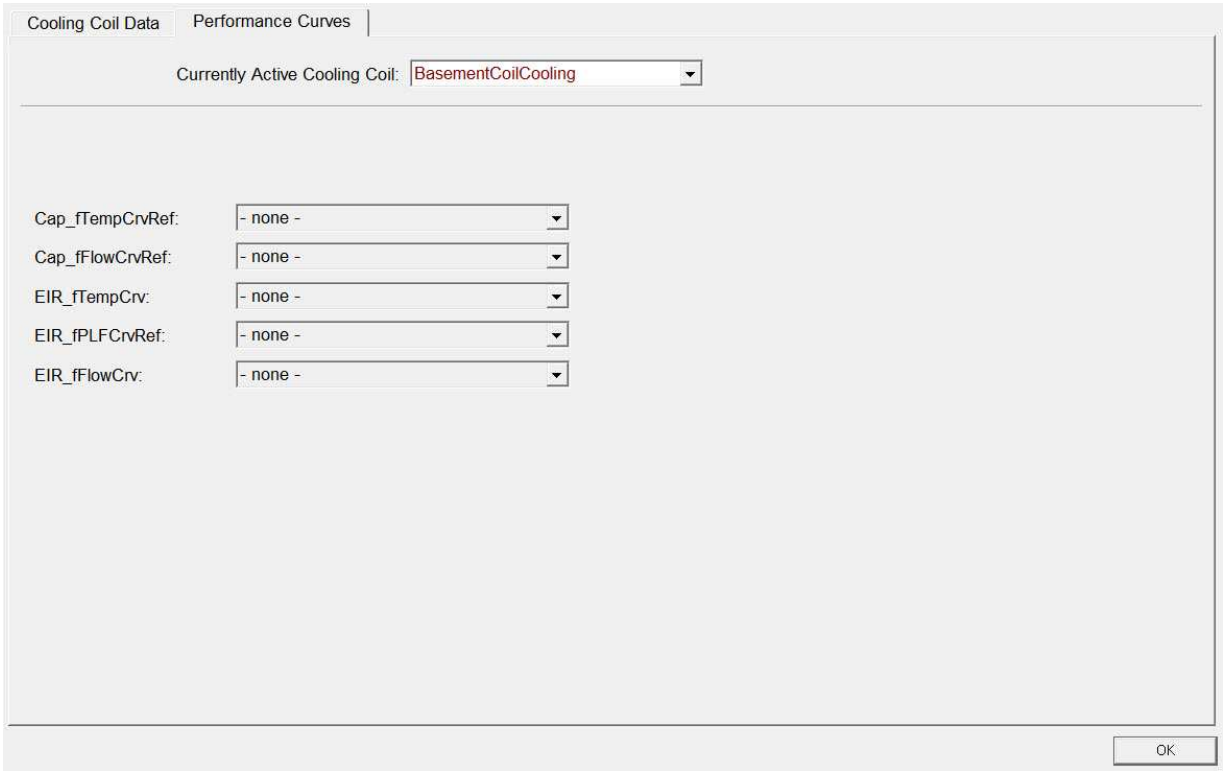
Input Summary:

- **Currently Active Air Segment:** The name of the currently selected Air Segment.
- **Name**: The name of the air segment.
- **Type**: The type of Air Segment. Options are Supply, Return, Relief, DualDuctSplitter, ExhaustSegment and MakeUpAIr.

Cooling Coil Data Screen (Chilled Water)



Cooling Coil Data Screen (Chilled Water), Performance Curves Tab



Input Summary:

- **Currently Active Cooling Coil:** The name of the currently selected cooling coil.
- **Name**: Name of the cooling coil.
- **Type:** The type of cooling coil. Options available are Chilled Water and Direct Expansion.
- **Inlet FluidSeg**: Defines the inlet/supply-side fluid segment of hydronic coils.
- **Outlet FluidSeg:** Defines the outlet/return-side fluid segment of hydronic coils.

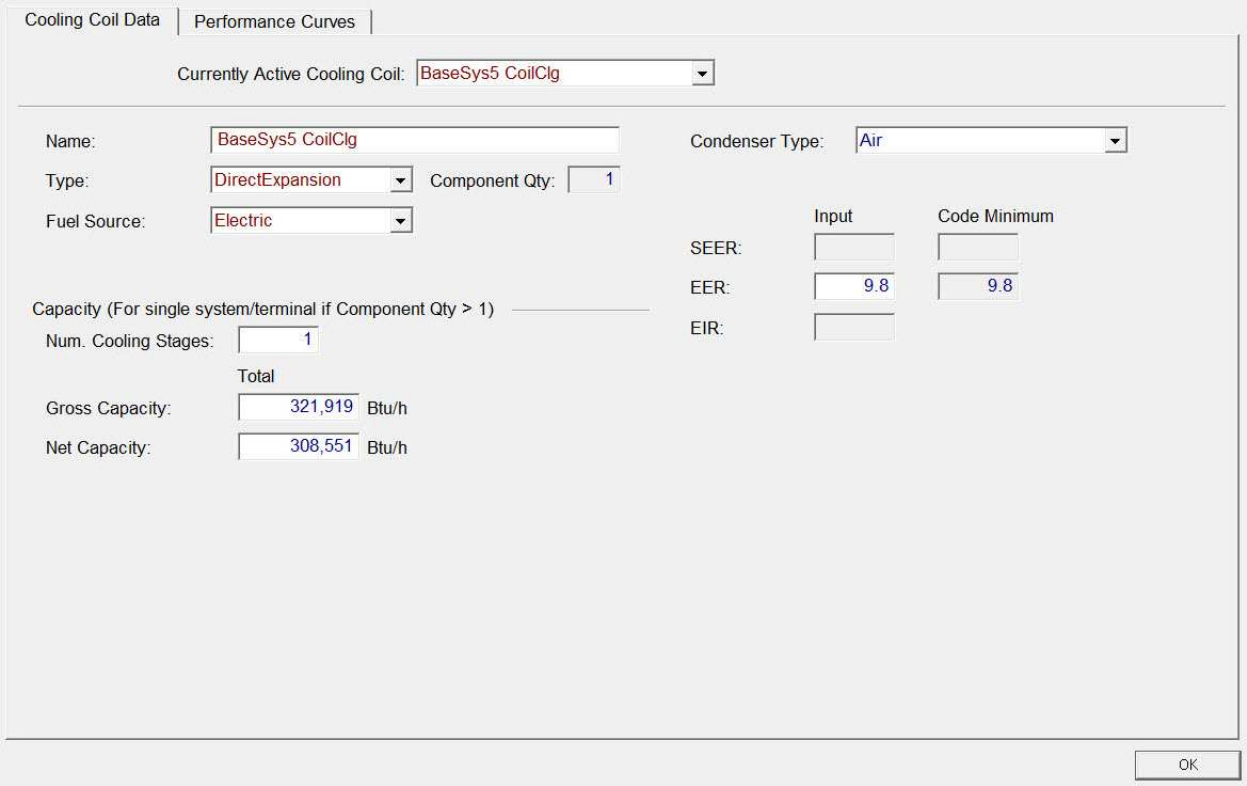
Capacity section

- **Gross Capacity** (Total): The gross total (both sensible and latent) cooling capacity of a cooling coil or packaged DX system at AHRI rating conditions.
  The gross capacity is the total cooling capacity without adjustments for fan heat.
- **Design Flow Rate**: The rate of water moving through the coil.
- **Condenser Type:** The type of condenser for a direct expansion (DX) cooling system. Options available are Air, Evaporatively Cooled, Water Source, Groundwater Source and Ground Source.
- **SEER** (Input): The Seasonal Energy Efficiency Ratio (SEER) is a term used to describe the seasonal performance of a DX cooling system. It is determined in accordance with AHRI standards.
- **SEER** (Code Minimum): Code Minimum SEER value.
- **EER** (Input): The cooling efficiency of a direct expansion (DX) cooling system at AHRI rated conditions.
- **EER** (Code Minimum): Code Minimum EER value.
- **EIR** (Input): The cooling efficiency of a direct expansion (DX) cooling system, described for simulation purposes. Energy Input Ratio (EIR) is the inverse of the COP.

Performance Curves tab

- **Cap_fTempCrvRef**: A curve hat describes the adjustment of cooling coil capacity as a function of temperature.
- **Cap_fFlowCrvRef**: Normalized curve that varies cooling capacity as a function of airflow, which affects system latent capacity. Used for EnergyPlus DX coil model only.
- **EIR_fTempCrv**: Normalized curve that varies full-load efficiency (EIR) as a function of indoor coil and condenser conditions.
- **EIR_fPLFCrvRef**: Normalized curve that varies full-load efficiency (EIR) as a function of part-load factor. This curve type is specific to EnergyPlus.
- **EIR_fFlowCrv**: Normalized curve that varies full-load efficiency (EIR) as a function of indoor coil flow. This curve type is specific to EnergyPlus.

Cooling Coil Data Screen (Direct Expansion)

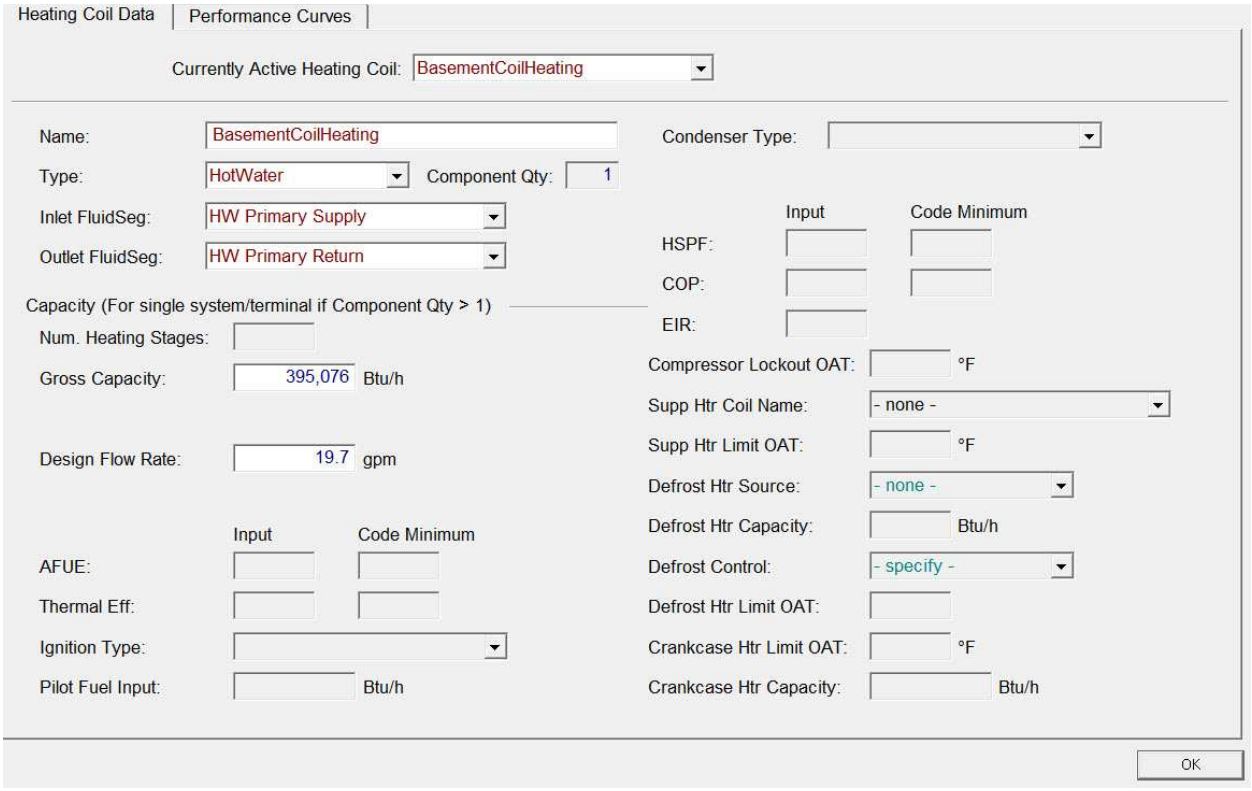


Input Summary:

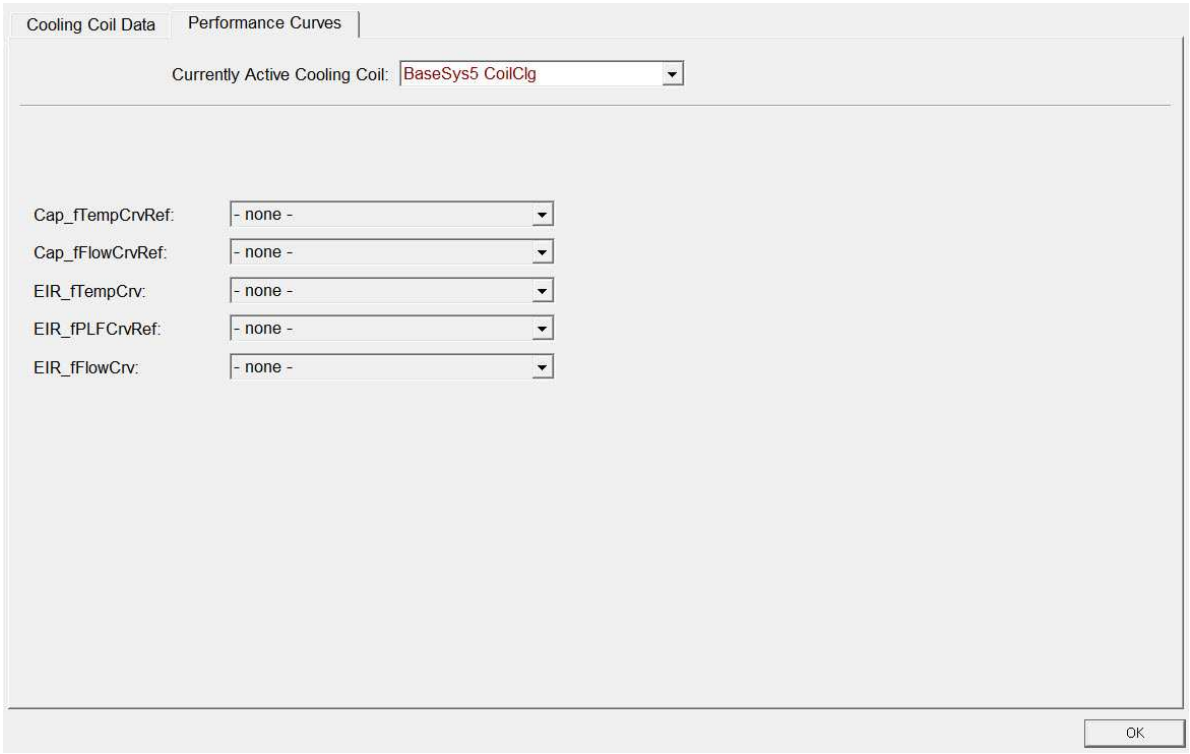
- **Currently Active Cooling Coil**: The name of the currently selected cooling coil.
- **Name**: Name of the cooling coil.
- **Type:** The type of cooling coil. Options available are Chilled Water and Direct Expansion.
- **Fuel Source:** Electric is the only source of fuel for direct expansion.
- **Num. Cooling Stages:** The number of mechanical cooling stages for a DX cooling coil. This applies to DX systems with more than one stage of DX cooling. This system is typically a packaged unit with multiple compressors and a two-speed or variable-speed fan.
- **Net Capacity** (Total): The net total (both sensible and latent) cooling capacity (both sensible and latent) of a cooling coil in unitary system at AHRI conditions.
  The net capacity is the total cooling capacity of the coil after adjusting for fan heat at rated conditions.
- **Gross Capacity** (Total): The gross total (both sensible and latent) cooling capacity of a cooling coil or packaged DX system at AHRI rating conditions.
  The gross capacity is the total cooling capacity without adjustments for fan heat.
- **Condenser Type:** The type of condenser for a direct expansion (DX) cooling system. Options available are Air, Evaporatively Cooled, Water Source, Groundwater Source and Ground Source.
- **SEER** (Input): The Seasonal Energy Efficiency Ratio (SEER) is a term used to describe the seasonal performance of a DX cooling system. It is determined in accordance with AHRI standards.
- **SEER** (Code Minimum): Code Minimum SEER value.

- **EER** (Input): The cooling efficiency of a direct expansion (DX) cooling system at AHRI rated conditions.
- **EER** (Code Minimum): Code Minimum EER value.
- **EIR** (Input): The cooling efficiency of a direct expansion (DX) cooling system, described for simulation purposes. Energy Input Ratio (EIR) is the inverse of the COP.

Heating Coil Data Screen (Hot Water, Steam)



Heating Coil Data Screen (Hot Water, Steam) Performance Curves Tab



Input Summary:

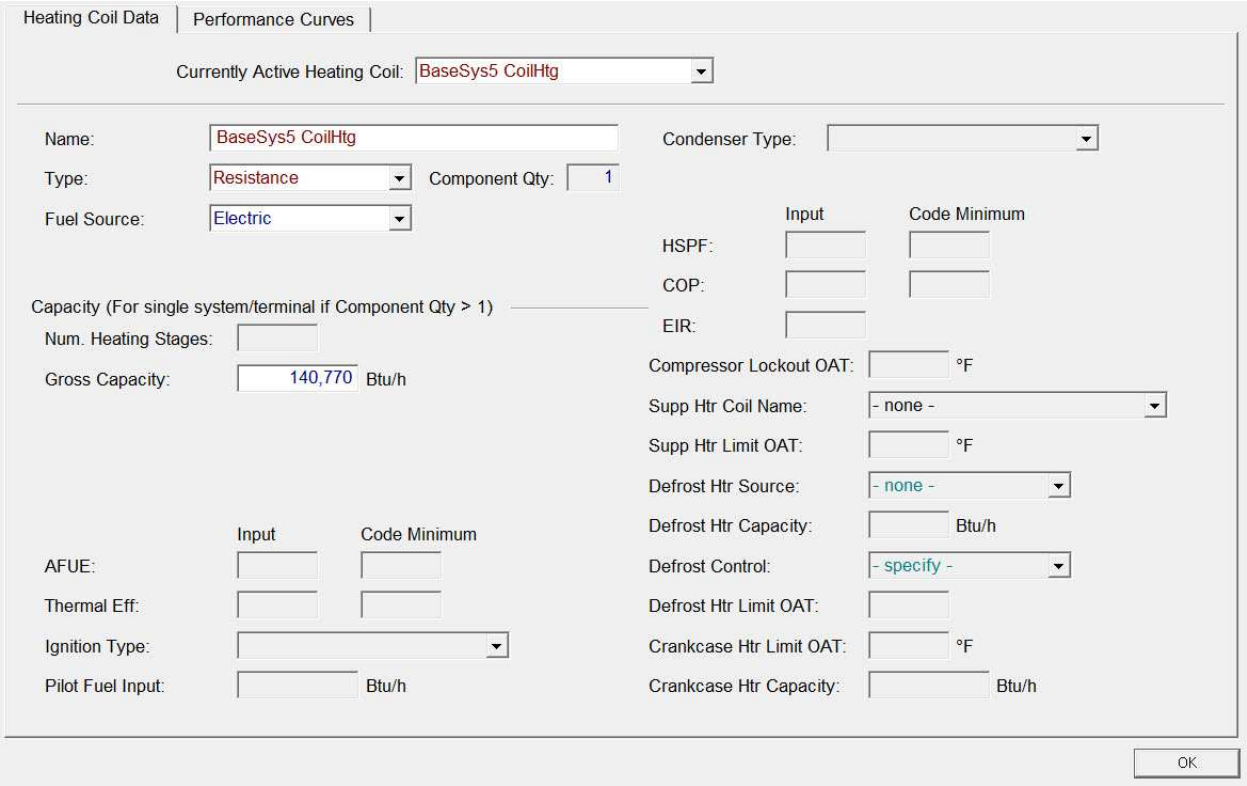
- **Currently Active Heating Coil**: The name of the currently selected heating coil.
- **Name:** The name of the heating coil.
- **Type:** The type of heating coil. Options are Resistance, Furnace, Heat Pump, Hot Water and Steam.
- **Component Qty**: The number of components.
- **Condenser Type:** The type of condenser for heat pump heating systems. Options include Air, WaterSource, Groundwater Source and GroundSource.
- **Inlet FluidSeg**: Defines the inlet/supply-side fluid segment of hydronic/steam coils.
- **Outlet FluidSeg:** Defines the outlet/return-side fluid segment of hydronic/steam coils.

Capacity section

- **Num. Heating Stages**: The number of heating stages for a furnace or heat pump heating coil. This applies to heating coils with more than one stage of heating. This system is typically a packaged unit with multiple heat pump compressors or a furnace with multiple firing rates.
- **Gross Capacity:** The gross heating capacity of the coil at AHRI conditions without adjustments for fan heat.
- **Design Flow Rate:** The design water volume flow rate (gpm) through the coil.
- **HSPF** (Input): The Heating Season Performance Factor (HSPF) is an indicator of expected, average seasonal heat pump efficiency. It is determined in accordance with AHRI Standards.
- **HSPF** (Code Minimum): The Code minimum HSPF.
- **COP** (Input): The heating efficiency of a heat pump at AHRI rated conditions.
- **COP** (Code Minimum): The Code minimum COP.
- **EIR** (Input): The heating efficiency of a heat pump heating coil, described for simulation purposes. Energy Input Ratio (EIR) is the inverse of the COP.
- **EIR** (Code Minimum): The Code minimum EIR.
- **Comp. OA Temp. Limit**: The outside dry-bulb temperature below which the heat pump supplemental heating is allowed to operate.
- **AFUE** (Input): The Annual Fuel Utilization Efficiency (AFUE) is an indicator of expected, seasonal furnace efficiency. It is determined in accordance with DOE Test Standards.
- **AFUE** (Code Minimum): The Code minimum AFUE.
- **Thermal Eff** (Input): The heating efficiency of a furnace at AHRI rated conditions.
- **Thermal Eff** (Code Minimum): The Code minimum Thermal efficiency.
- **Ignition Type**: The method used to start combustion in fuel-fired furnaces.
- **Pilot Fuel Input:** The fuel input for a pilot light on a furnace.
- **HIR_fPLRCrvRef**: Normalized curve that varies full-load efficiency as a function of part-load ratio.
- **Cap_fTempCrvRef**: A curve that describes the adjustment of a heat pump heating coil capacity as a function of temperature.
- **EIR_fPLFCrvRef**.: Normalized curve that varies full-load efficiency (EIR) as a function of part-load factor. This curve type is specific to EnergyPlus.
- **EIR_fTempCrvRef**.: Normalized curve that varies full-load efficiency (EIR) as a function of indoor coil and condenser conditions.

- **Compressor Lockout OAT**: The outside dry-bulb temperature below which the heat pump supplemental heating is allowed to operate.
- **Supp Htr Coil Name**: Select the Heating Coil.
- **Supp Htr Limit OAT:** The outside dry-bulb temperature below which the heating coil is allowed to operate.
- **Defrost Htr Source**: The fuel used for defrosting the evaporator.
- **Defrost Htr Capacity**: The designed power of the defrost.
- **Defrost Control**: Select if defrost operates at a specific time or when required.
- **Defrost Htr Limit OAT:** The outside dry-bulb temperature below, which the defrost is allowed to operate.
- **Crankcase Htr Limit OAT**: The outside dry-bulb temperature below which the crankcase heater is allowed to operate.
- **Crankcase Htr Capacity**: The designed power of the crankcase heater.

Heating Coil Data Screen (Resistance, Furnace, Heat Pump)

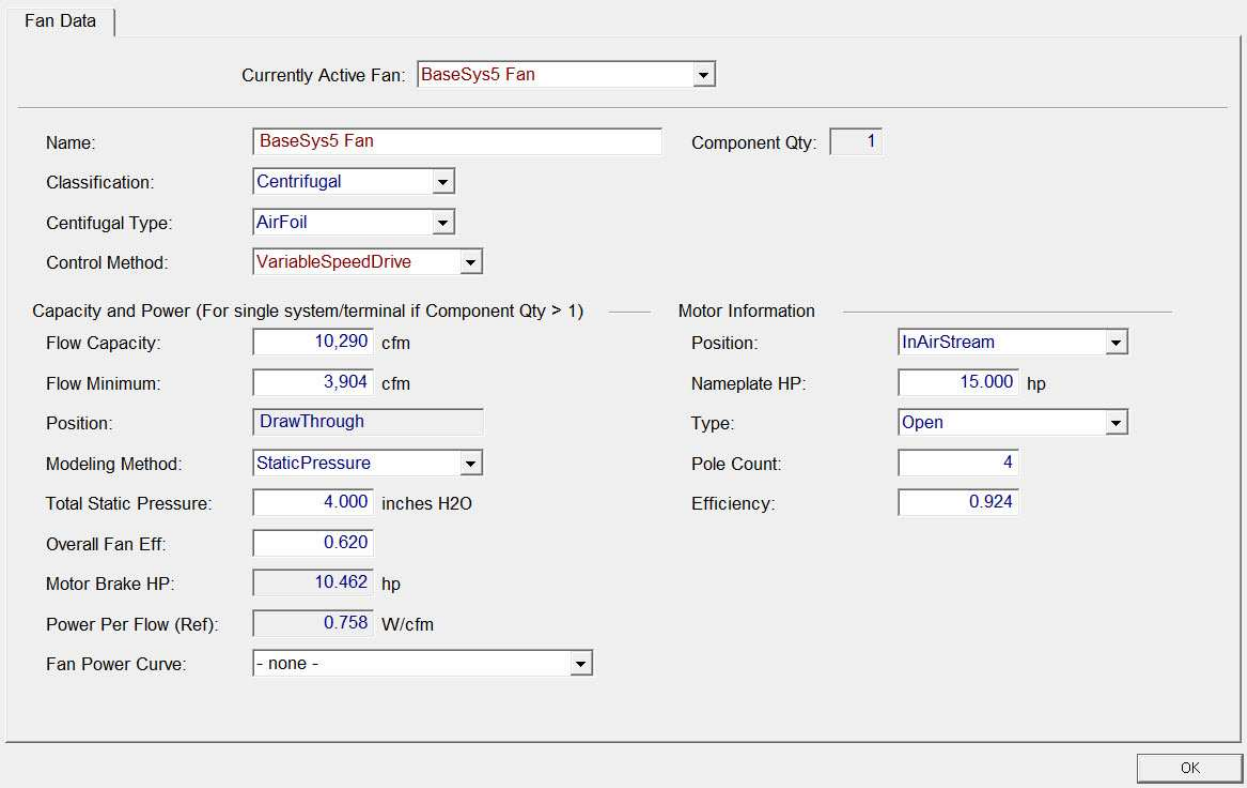


Input Summary:

- **Currently Active Heating Coil**: The name of the currently selected heating coil.
- **Name:** The name of the heating coil.
- **Type:** The type of heating coil. Options are Resistance, Furnace, Heat Pump, Hot Water and Steam.
- **Condenser Type**: The type of condenser for heat pump heating systems. Options include Air, WaterSource, Groundwater Source and GroundSource.
- **Fuel Source:** The fuel driving the heating coil.
- **Num. Heating Stages:** The number of heating stages for a furnace or heat pump heating coil. This applies to heating coils with more than one stage of heating. This system is typically a packaged unit with multiple heat pump compressors or a furnace with multiple firing rates.
- **Gross Capacity:** The gross heating capacity of the coil at AHRI conditions without adjustments for fan heat.
- **HSPF** (Input): The Heating Season Performance Factor (HSPF) is an indicator of expected, average seasonal heat pump efficiency. It is determined in accordance with AHRI Standards.
- **HSPF** (Code Minimum): The Code minimum HSPF.
- **COP** (Input): The heating efficiency of a heat pump at AHRI rated conditions.
- **COP** (Code Minimum): The Code minimum COP.
- **EIR** (Input): The heating efficiency of a heat pump heating coil, described for simulation purposes. Energy Input Ratio (EIR) is the inverse of the COP.

- **Compressor Lockout OAT**: The outside dry-bulb temperature below which the heat pump supplemental heating is allowed to operate.
- **Supp Htr Coil Name**: Select the Heating Coil.
- **Supp Htr Limit OAT**: The outside dry-bulb temperature below which the heating coil is allowed to operate.
- **Defrost Htr Source**: The fuel used for defrosting the evaporator.
- **Defrost Htr Capacity**: The designed power of the defrost.
- **Defrost Control**: Select if defrost operates at a specific time or when required.
- **Defrost Htr Limit OAT**: The outside dry-bulb temperature below, which the defrost is allowed to operate.
- **Crankcase Htr Limit OAT**: The outside dry-bulb temperature below which the crankcase heater is allowed to operate.
- **Crankcase Htr Capacity**: The designed power of the crankcase heater.
- **AFUE** (Input): The Annual Fuel Utilization Efficiency (AFUE) is an indicator of expected, seasonal furnace efficiency. It is determined in accordance with DOE Test Standards.
- **AFUE** (Code Minimum): The Code minimum AFUE
- **Thermal Eff** (Input): The heating efficiency of a furnace at AHRI rated conditions.
- **Thermal Eff** (Code Minimum): The Code minimum Thermal efficiency.
- **Ignition Type**: The method used to start combustion in fuel-fired furnaces.
- **Pilot Fuel Input**: The fuel input for a pilot light on a furnace.

Fan Data Screen



Input Summary:

- **Currently Active Fan**: The name of the currently selected fan.
- **Name**: The name of the fan.
- **Component Qty:** The number of duplicate systems represented by the current system. The number of duplicate systems can only be >1 when all attributes of the system are the same. If Count is specified to be >1, all parameters (capacities, power, etc.) should be specified for the single piece of equipment. The ruleset applies multipliers for the final simulation.
- **Classification:** Fan classification based on centrifugal or axial types.
- **Centrifugal Type**: The type of blade type used in a centrifugal fan. Options are AirFoil, BackwardInclined, ForwardCurved.
- **Control Method**: The method used to control fan flow. Options are Constant Volume, VariableSpeedDrive, Dampers and InletVanes.

Capacity and Power section

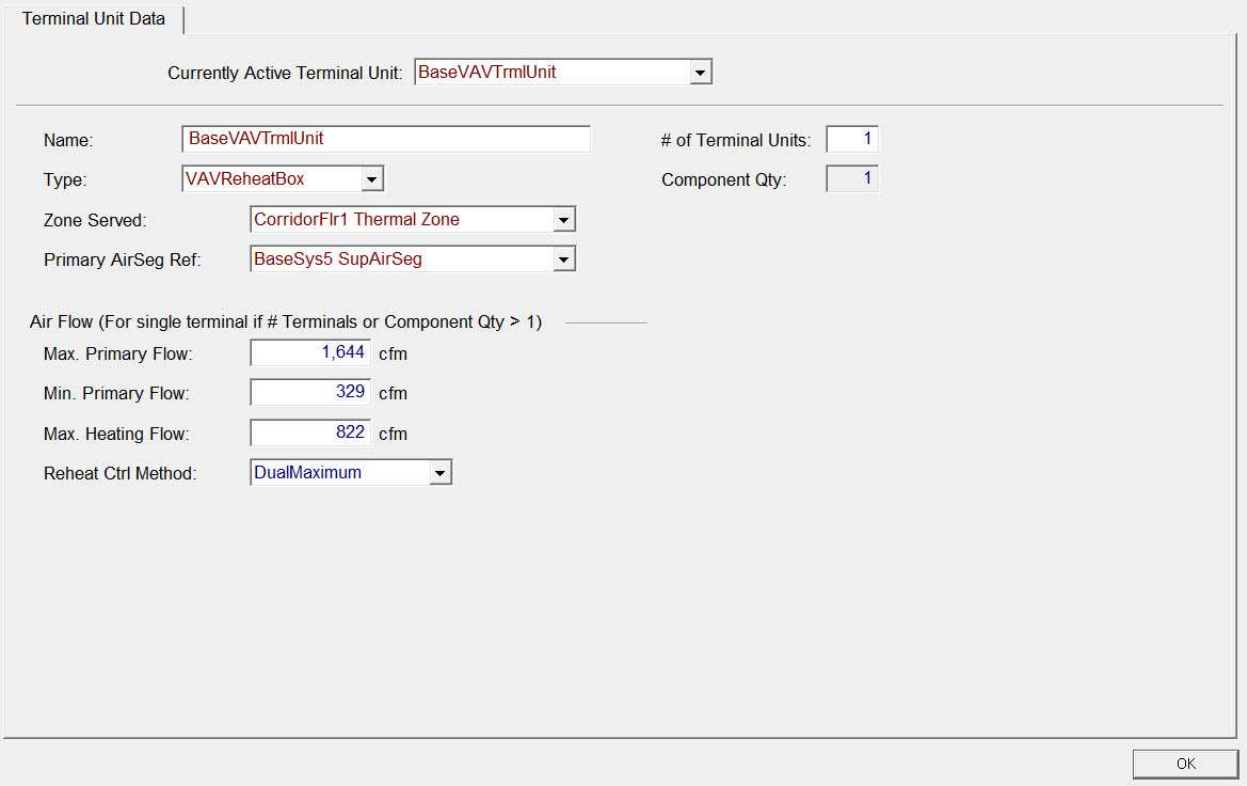
- **Flow Capacity**: The design air flow rate of the fan at design conditions.
  This building descriptor sets the 100 percent point for the fan part-load curve. This input should be at least as great as the sum of the design air flow specified for each of the thermal zones that are served by the fan system. For multiple deck systems, a separate entry should be made for each deck.
- **Flow Minimum**: The lowest flow rate rated for a fan.
- **Position**: The position of the supply fan relative to the cooling coil.

- **Modeling Method:** The method used to describe the design power consumption of a fan. Software commonly models fans in three ways. The simple method is for the user to enter the electric power per unit of flow (W/cfm). This method is commonly used for unitary equipment and other small fan systems. A more detailed method is to model the fan as a system whereby the static pressure, fan efficiency, part-load curve, and motor efficiency are specified at design conditions. A third method is to specify brake horsepower at design conditions instead of fan efficiency and static pressure. This is a variation of the second method whereby brake horsepower is specified in lieu of static pressure and fan efficiency. The latter two methods are commonly used for VAV and other larger fan systems.
- **Total Static Pressure:** The total static pressure drop across the fan at design conditions. The total static pressure (TSP) drop includes the pressure drop across components both internal and external to an air handler. It is important for both fan electric energy usage and fan heat gain calculations.
- **Overall Fan Eff**: The efficiency of the fan at design conditions.
  Overall fan efficiency includes belt/drive and fan efficiency, but does not include the efficiency of the fan motor.
- **Motor Brake HP**: The design motor shaft brake horsepower of the fan.
  The motor brake horse power is the power at the motor shaft, including fan and drive efficiencies.
- **Power Per Flow (Ref):** The supply fan power, in Watts, per unit of flow, in CFM
- **Fan Power Curve**: A part-load power curve which represents the percentage full-load power draw of the supply fan as a function of the percentage full-load air flow.

Motor Information section

- **Position**: The position of the supply fan motor relative to the cooling air stream.
- **Nameplate HP**: The nameplate HP of the fan motor.
- **Type:** Defines if the motor is open or closed.
- **Pole Count**: The number of pole electromagnetic windings in the motor's stator and used to assign MotorEfficiency. Poles are always paired, so PoleCount is always a multiple of 2.
- **Efficiency:** The efficiency of the motor serving a fan.

Terminal Unit Data Screen


Terminal Unit Data
Currently Active Terminal Unit: BaseVAVTrmlUnit
Name: BaseVAVTrmlUnit
# of Terminal Units: 1
Type: VAVReheatBox
Component Qty: 1
Zone Served: CorridorFlr1 Thermal Zone
Primary AirSeg Ref: BaseSys5 SupAirSeg
Air Flow (For single terminal if # Terminals or Component Qty > 1)
Max. Primary Flow: 1,644 cfm
Min. Primary Flow: 329 cfm
Max. Heating Flow: 822 cfm
Reheat Ctrl Method: DualMaximum
OK

Input Summary:

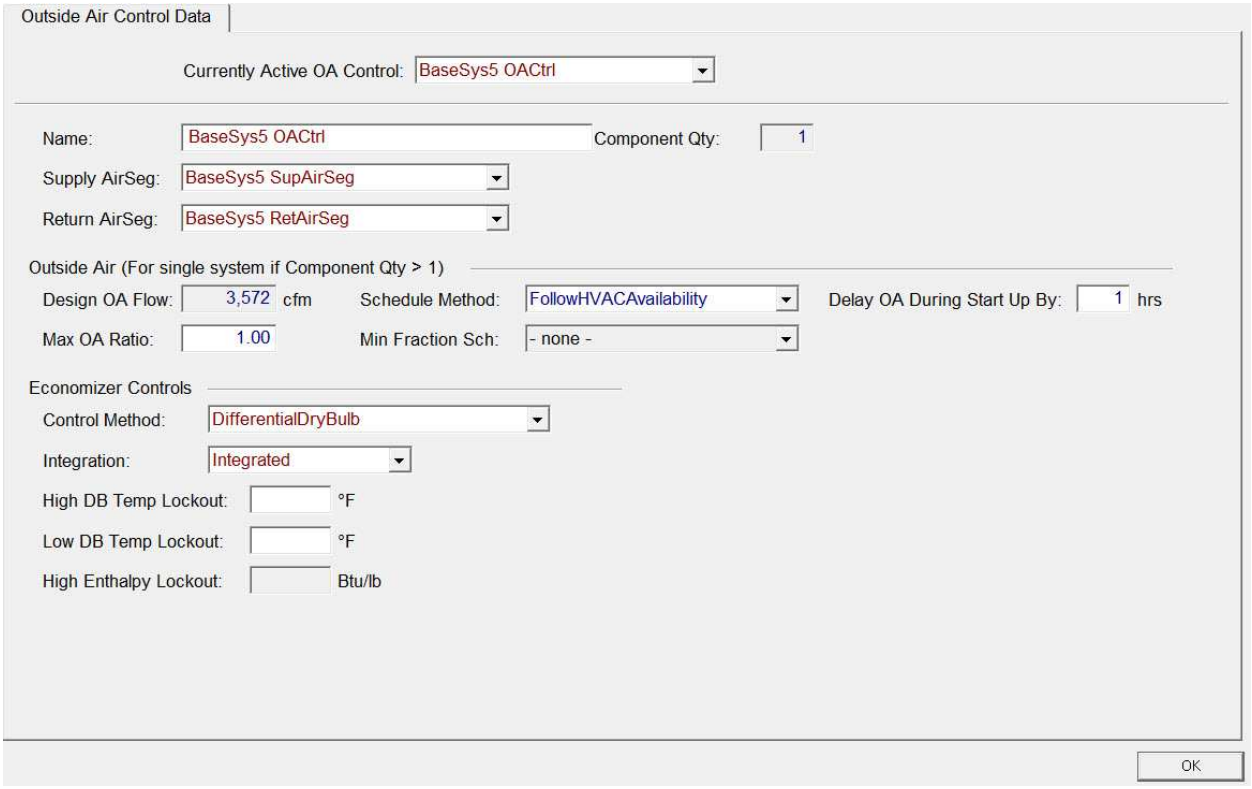
- **Currently Active Terminal Unit:** The name of the currently selected terminal unit.
- **Name:** The name of the terminal unit.
- **# of Terminal Units:** The number of duplicate terminal units represented by the current terminal unit
- **Type**: The type of terminal used to deliver and if applicable, regulate air delivery to a thermal zone.
- **Component Qty:** The number of duplicate systems represented by the current system. The number of duplicate systems can only be >1 when all attributes of the system are the same. If Count is specified to be >1, all parameters (capacities, power, etc.) should be specified for the single piece of equipment. The ruleset applies multipliers for the final simulation.
- **Zone Served**: The name of the thermal zone that the terminal unit provides air to.
- **Primary AirSeg Ref**: Definition of the supply air segment that provides primary air to the terminal unit.

Air Flow section

- **Max. Primary Flow**: The zone air delivery rate at design conditions. For uncontrolled terminal units, describes the design air flow rate provided to zones when the system is on. For VAV systems, specifies the maximum air flow delivered to the zone by the terminal unit.
- **Min. Primary Flow**: The minimum air flow rate of variable volume terminal units
- **Max. Heating Flow**: The maximum primary air flow to the terminal in heating mode

- **Reheat Ctrl Method**: The air/temperature control strategy for VAV reheat box in heating mode. Options available are Single Maximum and Dual Maximum.
    - Single Maximum: The airflow is set to a minimum constant value in both the deadband and heating mode. The minimum airflow setpoint is typically 30 to 50 percent of maximum. This control mode typically has a higher minimum airflow than the minimum used in the dual maximum below, resulting in more frequent reheat.
    - Dual Maximum: Raises the SAT as the first stage of heating, and increases the airflow to the zone as the second stage of heating, as follows:
        1. The first stage of heating consists of modulating the zone supply air temperature setpoint up to a maximum setpoint no larger than 95°F while the airflow is maintained at the deadband flow rate.
        2. The second stage of heating consists of modulating the airflow rate from the deadband flow rate up to the heating maximum flow rate (50 percent of design flow rate).

Outside Air Control Data Screen


Outside Air Control Data
Currently Active OA Control: BaseSys5 OACtrl
Name: BaseSys5 OACtrl
Component Qty: 1
Supply AirSeg: BaseSys5 SupAirSeg
Return AirSeg: BaseSys5 RetAirSeg
Outside Air (For single system if Component Qty > 1)
Design OA Flow: 3,572 cfm
Schedule Method: FollowHVACAvailability
Delay OA During Start Up By: 1 hrs
Max OA Ratio: 1.00
Min Fraction Sch: - none -
Economizer Controls
Control Method: DifferentialDryBulb
Integration: Integrated
High DB Temp Lockout: °F
Low DB Temp Lockout: °F
High Enthalpy Lockout: Btu/lb
OK

Input Summary:

- **Currently Active OA Control**: The name of the currently selected outdoor air control.
- **Name:** The name of the outside air control.
- **Component Qty:** The number of duplicate systems represented by the current system. The number of duplicate systems can only be >1 when all attributes of the system are the same. If Count is specified to be >1, all parameters (capacities, power, etc.) should be specified for the single piece of equipment. The ruleset applies multipliers for the final simulation.
- **Supply AirSeg**: Defines the supply air segment of the Air System.
- **Return AirSeg**: Defines the return/relief air segment of the Air System.

Outside Air section

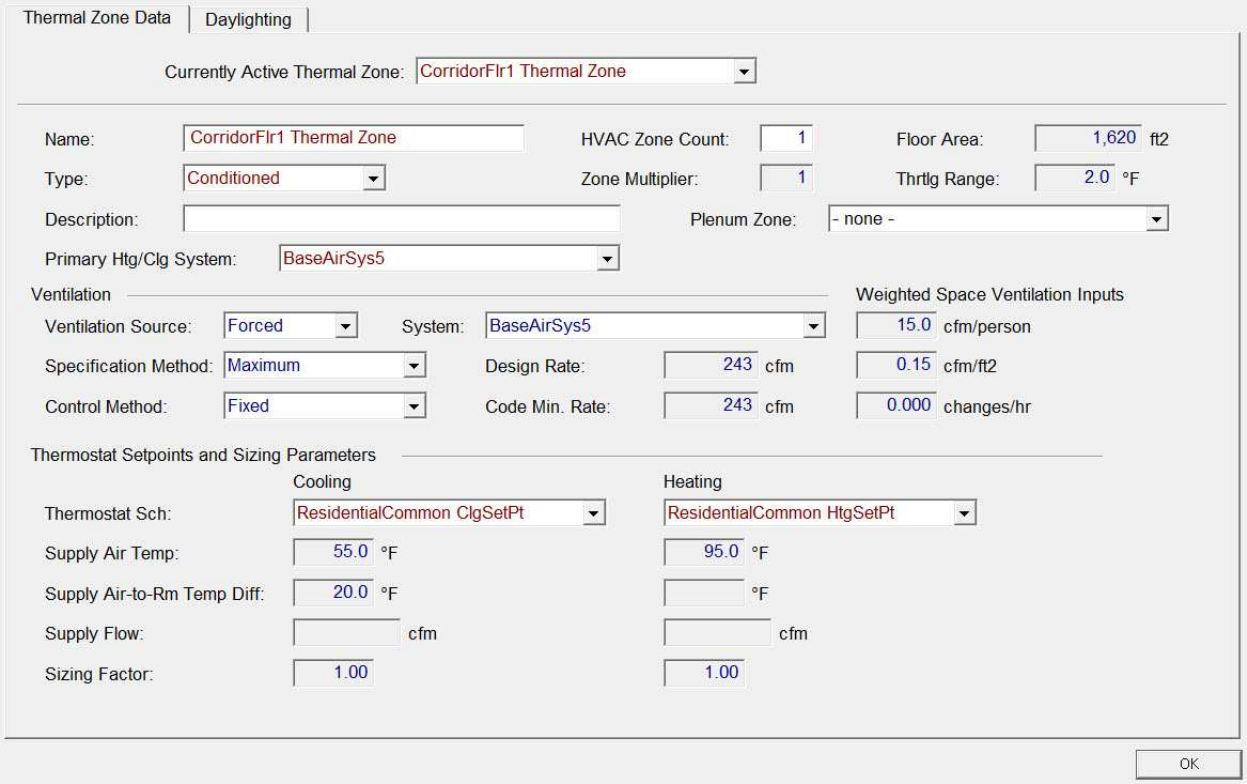
- **OA Flow** (For individual systems, not total if # of systems>1) Design Flow: The rate of outside air that needs to be delivered by the system at design conditions. Minimum ventilation requirements specified by Standard 120(b)2 as the greater of 15 cfm/person and the minimum ventilation rates specified in Appendix 5.4. For systems serving laboratory spaces, the system shall be 100 percent outside air, with ventilation rates determined by the Authority Having Jurisdiction.
- **Schedule Method:** The method used to describe the minimum amount of ventilation (outdoor) air that is provided by the system.
- **Delay OA During Startup By**: If the OAScheduleMethod is 'FollowHVACAvailability', this positive integer value indicates the number of hours that the system outside air flow is zero during system start up.

- **OA Flow** (For individual systems, not total if # of systems>1) Max Ratio: The maximum ratio of outside air that a system can provided, defined as a percentage of the design supply air. Applies to systems with modulating outside air dampers. Economizers for smaller systems (<54,000 Btu/h) are assumed to have a restricted intake capacity.
- **Min Fraction Sch**: A schedule that defines the minimum outdoor air flow rate as a fraction of total system air flow.

Economizer Controls section

- **EconoCtrlMthd**: The method used to control the air-side economizer.
  An air-side economizer increases outside air ventilation during periods when mechanical cooling loads can be reduced by increasing outside air flow. The control types include:
  - No economizer: Fixed outside are fraction at the system's design outside air flow when the system fan runs.
  - Fixed dry-bulb: The system shifts to 100 percent outside air and shuts off the cooling when the temperature of the outside air is equal to or lower than the supply air temperature.
  - Differential dry-bulb: The system shifts to 100 percent outside air when the temperature of the outside air is lower than the return air temperature but continues to operate the cooling system until outside air temperature reaches the supply air temperature.
  - Differential enthalpy: The system shifts to 100 percent outside air when the enthalpy of the outside air is lower than the return air enthalpy but continues to operate the cooling system until the outside air enthalpy reaches the supply air enthalpy.
  - Differential enthalpy and dry-bulb: Utilizes combination of both the DifferentialDryBulb and DifferentialEnthalpy economizer control strategies.
- **Integration**: Specifies whether or not the economizer is integrated with mechanical cooling. Options include:
  - NonIntegrated: The system runs the economizer as the first stage of cooling. When the economizer is unable to meet the load, the economizer returns the outside air damper to the minimum position and the compressor turns on as the second stage of cooling.
  - Integrated: The system can operate with the economizer fully open to outside air and mechanical cooling active (compressor running) simultaneously, even on the lowest cooling stage.
- **High DB Temp Lockout**: The outside air drybulb temperature above which the economizer will return to its minimum position.
- **Low DB Temp Lockout**: The outside air drybulb temperature below which the economizer will return to its minimum position.
- **High Enthalpy Lockout**: The outside air drybulb temperature above which the economizer will return to its minimum position.

Thermal Zone Data Screen



Input Summary:

- **Currently Active Thermal Zone**: The name of the selected Thermal Zone.
- **Name:** The name of the thermal zone made up of 50 or fewer alphanumeric characters.

HVAC Zone Count: The number of building HVAC zones represented by the modeled thermal zone. This property is used to simuluate multiples of a single thermal zone. All spaces that reference the thermal zone must have the same multiplier, and spaces with multipliers greater than one cannot be children of different Story objects. The following SDD modeling rules for Multipliers must be followed: 1. All spaces that are combined into a thermal zone must have the same Multiplier. 2. Spaces that are combined into a thermal zone cannot span multiple stories

- **Floor Area**: The gross floor area of a thermal zone (before multiplier is applied); including walls and minor spaces for mechanical or electrical services such as chases that are not assigned to other thermal zones. Larger mechanical spaces and electrical rooms should not be combined.
- **Type**: Designation of the thermal zone as directly conditioned space, indirectly conditioned space (i.e., conditioned only by passive heating or cooling from an adjacent thermal zone), or plenum (i.e., unoccupied but partially conditioned as a consequence of its role as a path for returning air).
- **Zone Multiplier**: This property is used to simulate multiples of a single thermal zone. All spaces that reference the thermal zone must have the same multiplier, and thermal zones with multipliers greater than one cannot be children of different Story objects. The following SDD modeling rules for Multipliers must be followed:

  - All spaces that are combined into a thermal zone must have the same Multiplier.
  - Spaces that are combined into a thermal zone cannot span multiple stories.
  - All ThermalZones that are served by the same HVAC system must have the same Multiplier.
- **Thrtlg Range**: Thermostat throttling range is the number of degrees that the room temperature must change to cause the HVAC system to go from no heating or cooling (i.e., space temperatures floating) to full heating or cooling.
- **Desc**: A brief description of the thermal zone that ties the thermal zone to the building plans. The description may identify the spaces that make up the thermal zone or can be other descriptive information.
- **Plenum Zone**: Name of the plenum zone if the thermal zone has a plenum space.
- **Primary Htg/Clg System**: The name of the air or zone system that is the principal source of heating and/or cooling for the thermal zone. Only one unique AirSystem can be assigned to this field.

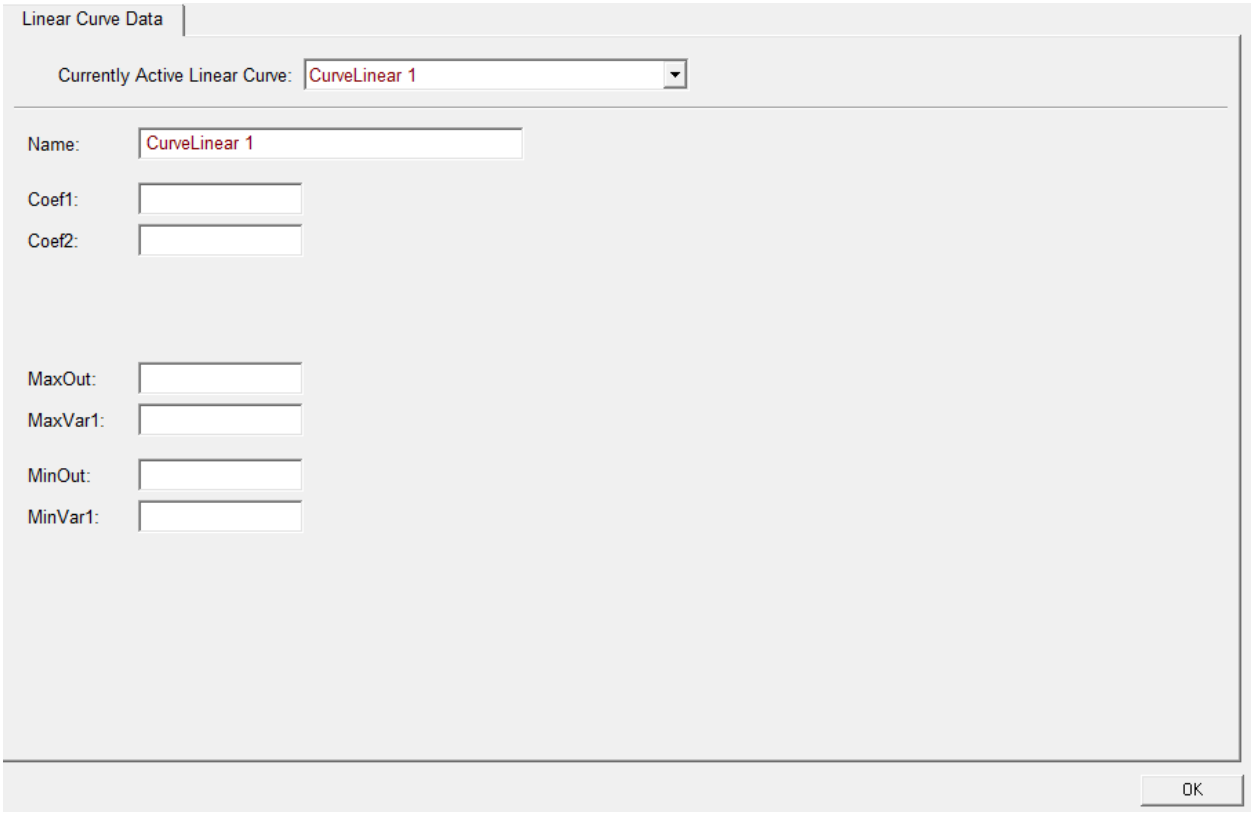
Ventilation section

- **Ventilation Source**: The source of ventilation for a thermal zone. Options are NotRequired, Forced, and Natural.
- **System**: The name of the air or zone system that provides ventilation air to the thermal zone. This is by default the same system as the primary air conditioning system.
- **Specification Method**: Options are: NoVentilation, Maximum, Sum, FlowPerPerson, FlowPerArea, AirChangesPerHour, and FlowPerZone.
- **Design Rate**: The quantity of ventilation air that is provided to the thermal zone at maximum occupancy. The default value is the larger of 15 cfm times the design occupancy from Appendix 5.4A or the conditioned floor area times the applicable ventilation rate from Appendix 5.4A or Table 120.1-A of the Standards.
- **Control Method**: The method used to vary the minimum ventilation flow. Ventilation airflow may be fixed at a specified rate or it may be reduced by the use of CO2 sensors or shut off based on an occupancy sensor.
- **Code Min. Rate**: The minimum quantity of ventilation air that must be provided to the space when it is occupied. The default value is the larger of 15 cfm times the design occupancy from Appendix 5.4A or the conditioned floor area times the applicable ventilation rate from Appendix 5.4A or Table 120.1-A of the Standards.

Thermostat Setpoints and Sizing Parameters section

- **Thermostat Sch**: HVAC zone cooling temperature schedule. The schedules specified in Appendix 5.4A and detailed in Appendix 5.4B is used as default.
- **Supply Air Temp**: The design cooling or heating supply air temperature for sizing zone/system airflows.
- **Supply Air-to-Rm Temp Diff**: The temperature difference between the supply air temperature and room air temperature used for sizing system supply fans.
- **Supply Flow**: The air flow provided to the thermal zone at the design cooling or heating condition. Applicable to sizing runs only.
- **Factor:** A factor applied to the autosized zone cooling air flow.

Linear Curve Data Screen



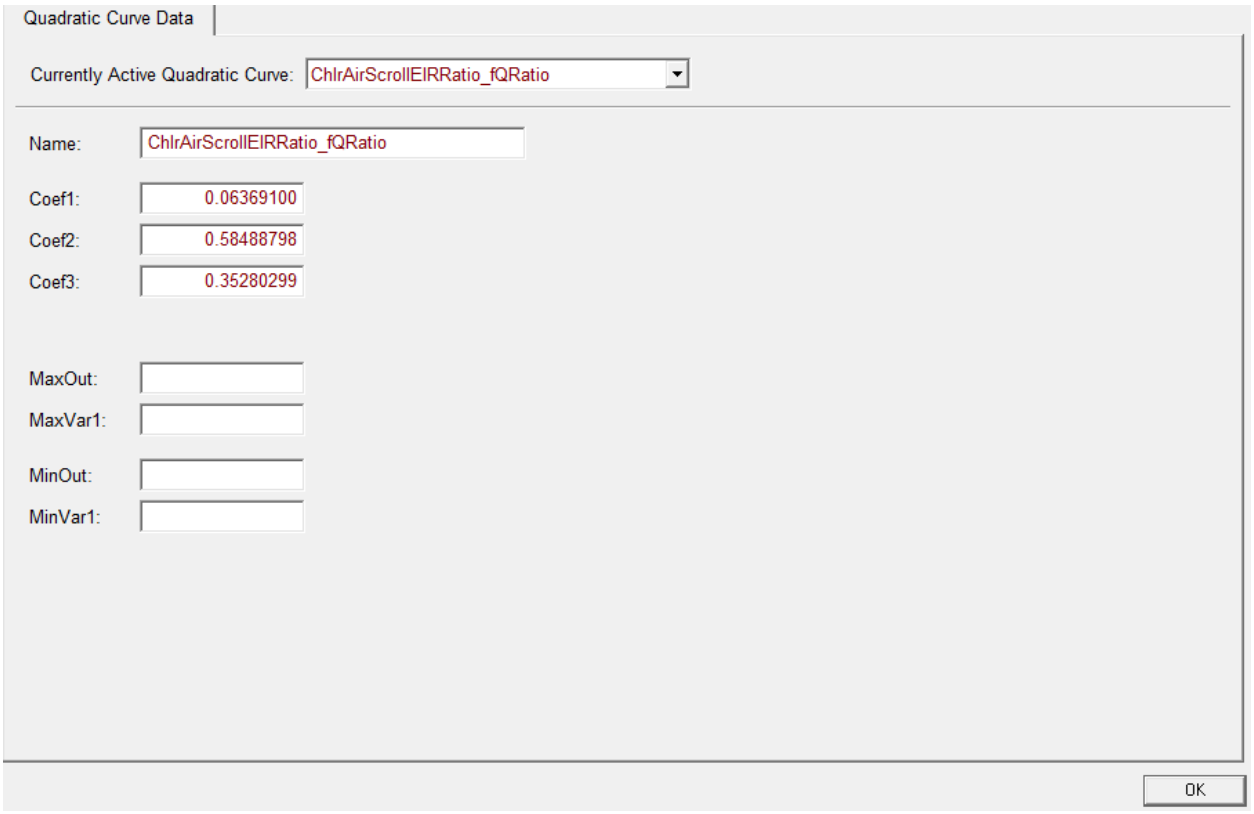
The linear curve consists of two coefficients and an independent variable. The minimum and maximum values for the independent variable can be specified as well as the minimum and maximum output of the performance curve.

Out = Coef1 + Coef2 * Var1

Input Summary:

- **Currently Active Linear Curve**: The name of the selected linear curve.
- **Name**: The name of the linear curve.
- **Coef1**: The constant coefficient in the equation.
- **Coef2**: The linear coefficient in the equation.
- **MaxOut:** The maximum allowable output value. (optional).
- **MaxVar1:** The maximum allowable value for the independent variable.
- **MinOut**: The minimum allowable output value. (optional)
- **MinVar1**: The minimum allowable value for the independent variable.

Quadratic Curve Data Screen



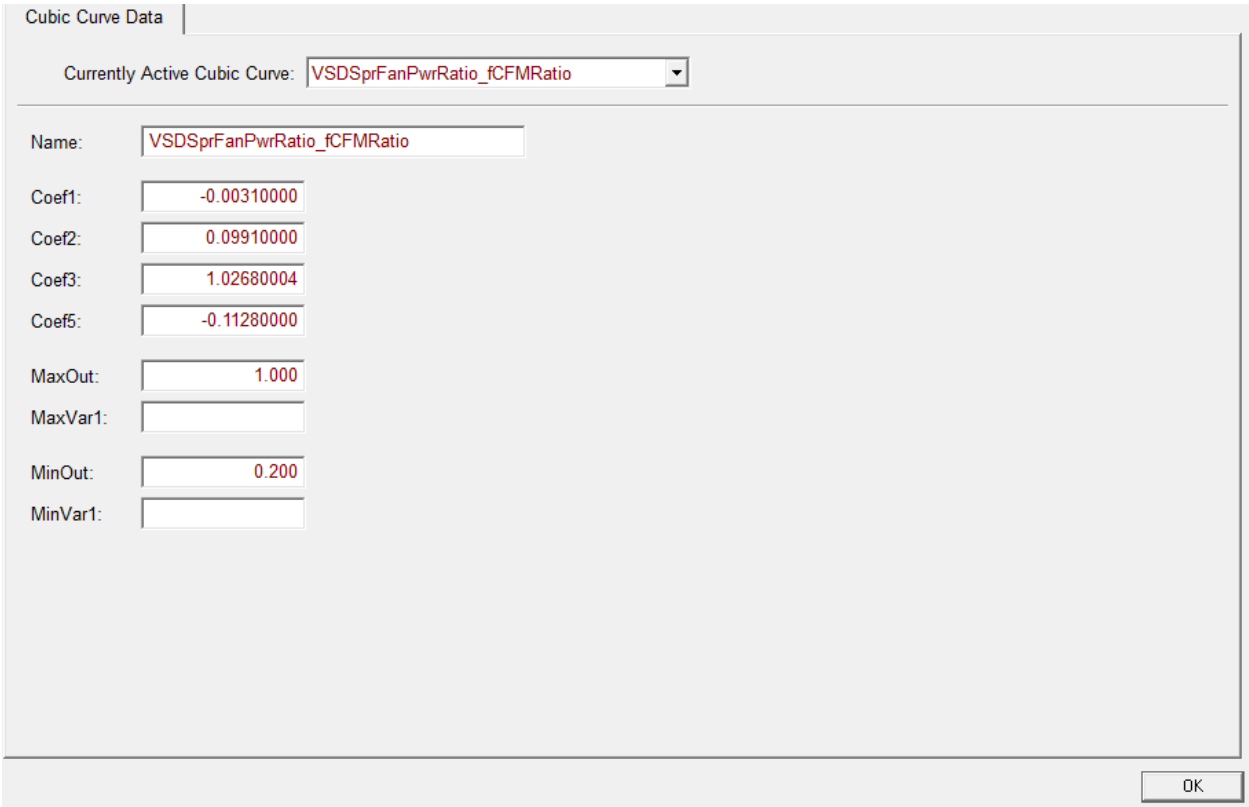
The quadratic curve consists of three coefficients and an independent variable. The minimum and maximum values for the independent variable can be specified as well as the minimum and maximum output of the performance curve.

Out = Coef1 + Coef2 * Var1 + Coef3 * Var1 ^ 2

Input Summary:

- **Currently Active Quadratic Curve:** The name of the active quadratic curve.
- **Name:** The name of the quadratic curve.
- **Coef1**: The constant coefficient in the equation.
- **Coef2**: The linear coefficient in the equation.
- **Coef3**: The quadratic coefficient in the equation.
- **MaxOut:** The maximum allowable output value. (optional)
- **MaxVar1**: The maximum allowable value for the independent variable.
- **MinOut**: The minimum allowable output value. (optional)
- **MinVar1**: The minimum allowable value for the independent variable.

Cubic Curve Data Screen



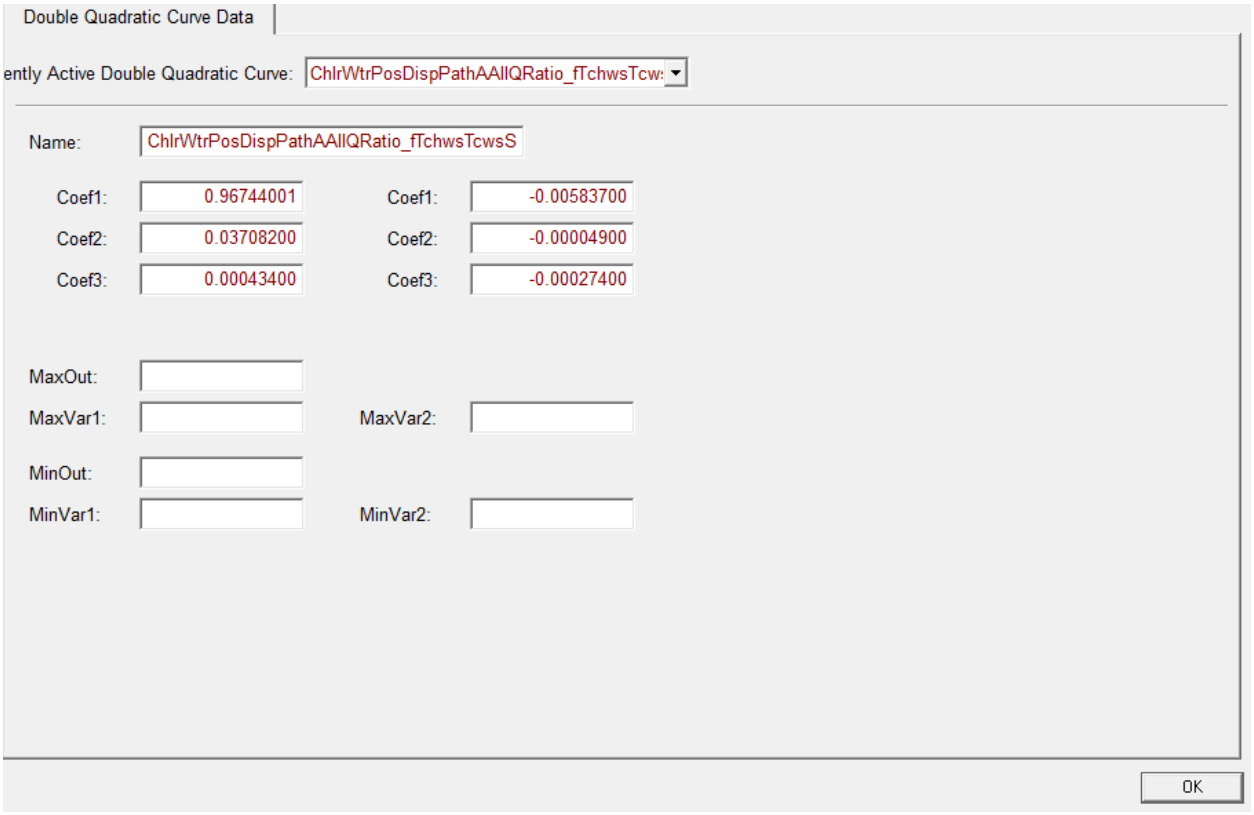
The cubic curve consists of four coefficients and an independent variable. The minimum and maximum values for the independent variable can be specified as well as the minimum and maximum output of the performance curve.

Out = Coef1 + Coef2 * Var1 + Coef3 * Var1 ^ 2 + Coef5 * Var1 ^ 2

Input Summary:

- **Currently Active Cubic Curve:** The name of the active cubic curve.
- **Name**: The name of the cubic curve.
- **Coef1**: The constant coefficient in the equation.
- **Coef2**: The linear coefficient in the equation.
- **Coef3**: The quadratic coefficient in the equation.
- **Coef5**: The cubic coefficient in the equation.
- **MaxOut**: The maximum allowable output value. (optional)
- **MaxVar1**: The maximum allowable value for the independent variable.
- **MinOut**: The minimum allowable output value. (optional)
- **MinVar1:** The minimum allowable value for the independent variable.

Double Quadratic Curve Data Screen



The double quadratic curve consists of two independent variables and three coefficients for each variable. The minimum and maximum values for the independent variable can be specified as well as the minimum and maximum output of the performance curve.

Out = Coef1 + Coef1 + Coef2 * Var1 + Coef2 * Var2 + Coef3 * Var1 ^ 2 + Coef3 * Var2 ^ 2

Input Summary:

- **Currently Active Double Quadratic Curve**: The name of the active double quadratic curve.
- **Name:** The name of the double quadratic curve.
- **Coef1:** The constant coefficient in the equation.
- **Coef2:** The linear coefficient in the equation.
- **Coef3:** The quadratic coefficient in the equation.
- **MaxOut**: The maximum allowable output value. (optional)
- **MaxVar1**: The maximum allowable value for the first independent variable.
- **MaxVar2**: The maximum allowable value for the second independent variable.
- **MinOut**: The minimum allowable output value. (optional)
- **MinVar1**: The minimum allowable value for the first independent variable.
- **MinVar2**: The minimum allowable value for the second independent variable.

Special Features and Modeling Assumptions

The Energy Commission is currently discussing the requirements for reporting Special Features in compliance software and will (1) update the ACM Reference Manual, and (2) implement the updated requirements in a future version of CBECC-Com before January 1, 2014. The following modeling assumptions are made by CBECC-Com.

Modeling Assumptions

- CBECC-Com uses the concept of three parallel sets of input for a single building modeled for compliance.
    1. The user model is the set of inputs entered by the user that reflect the actual specification of the as-designed building.
    2. The proposed model is generated by the software and applies modeling constraints to user inputs, when needed, for use in compliance. Values of prescribed inputs such as schedules or equipment power density are overridden with inputs to follow the rules in the ACM Reference Manual.
    3. The standard design model is the baseline for comparison.
- The CBECC software applies modeling concepts to identify building model inputs that can be modified by the user from those that cannot.
    - A prescribed input is a modeling input that is fixed for both the proposed design and the standard design (baseline). Examples of prescribed inputs are occupancy schedules and equipment power density (EPD) for a given space type.
    - A neutral input is a modeling input that is entered by the user, but the value for the standard design (baseline) is set by the software to match the user input. Examples of this type of input include climate zone, and the building geometry (excluding fenestration).
    - A user-defined input is a modeling input that is entered by the user, whose value is allowed to vary above or below the stringency level in the standard design. Examples of this type of input include lighting power and HVAC equipment efficiency.
- The modeling rules and input restrictions are defined in detail in the ACM Reference Manual, available on the California Energy Commission website.
- While most algorithms are handled automatically by the software, the CBECC software employs a calculation algorithm for recirculating water heating systems in multi-family water heating. Refer to Residential ACM Appendix RE for calculation details.
- While refrigeration systems are not modeled explicitly in the CBECC software, there is a means to specify the refrigeration capacity (Btu/h) and the location of the condenser (remote or in the space). CBECC assumes a fixed COP of 2.8 to calculate the heat rejection for condensers that are not located remotely. Refrigeration for modeling purposes is considered a “neutral” load – the same value is used in the proposed design and standard design model.

Field Verification

The following list of features must be verified in the field.

- NRFC rating for Fenestration.
- Thermal performance of Window Films. For details refer NA7 of 2013 Nonresidential Appendices.
- Thermal performance of Dynamic Glazing. For details refer NA7 of 2013 Nonresidential Appendices.
- Lighting Controls installed to earn a Power Adjustment Factor (PAF) in accordance with Section 140.6(a) 2. For details refer NA7 of 2013 Nonresidential Appendices.
- Lighting for a Videoconferencing Studio in accordance with Exception to Section 140.6(a)3T. For details refer NA7 of 2013 Nonresidential Appendices.
- Kitchen Exhaust Systems with Type I Hood Systems. For details refer NA7 of 2013 Nonresidential Appendices.
- Fault Detection and Diagnostic Systems – this is a mandatory feature for systems with capacity of 54,000 Btu/h and above.
- DHW Distribution Diagnostic Testing- Duct System Leakage Diagnostic Testing - Duct leakage testing for systems serving less than 5,000 ft2 of space that have ducts in unconditioned space. Refer to NA2 for field test details. To claim the prescriptive required leakage level (6%) or lower, the tests in Reference Appendix NA2 must be completed. Otherwise, a higher default level is assumed in the compliance model.
- Low Leakage Air- handling Unit verification.

Checklist for Compliance Submittal

CBECC-Com will produce the Certificate of Compliance for the Nonresidential Performance Compliance Method, NRCC-PRF-01-E, which meets the requirements of a compliance submittal.

Note: Please check Compliance Statement to make sure that the version you are using has been certified by the California Energy Commission to show compliance with California's 2013 Building Energy Efficiency Standards.

Sample Compliance Documentation

To be updated

Compliance Statement

CBECC-Com 2013-v1f may not be used to show compliance with California's 2013 Building Energy Efficiency Standards.

Related Publications

The following documents provide the basis for compliance with the 2013 Standards:

- 2013 Building Energy Efficiency Standards (http://www.energy.ca.gov/2012publications/CEC-400-2012-004/CEC-400-2012-004-CMF.pdf)
- 2013 Nonresidential Alternate Calculation Method Reference Manual (http://www.energy.ca.gov/2013publications/CEC-400-2013-004/CEC-400-2013-004-CMF.pdf)
- 2013 Nonresidential Compliance Manual (http://www.energy.ca.gov/2013publications/CEC-400-2013-002/CEC-400-2013-002-CMF.pdf)
- 2012 Appliance Efficiency Regulations (http://www.energy.ca.gov/2012publications/CEC-400-2012-019/CEC-400-2012-019-CMF.pdf)
- Reference Nonresidential Appendices (http://www.energy.ca.gov/2012publications/CEC-400-2012-005/CEC-400-2012-005-CMF.pdf)
- Reference Joint Appendices (http://www.energy.ca.gov/2012publications/CEC-400-2012-005/CEC-400-2012-005-CMF.pdf)